ENGINEERING NEWS

AND

AMERICAN RAILWAY JOURNAL.

Vol. XXIII. No. 13.

TABLE OF CONTENTS.

Engineering News of the Week 289

Technical and Illustrated Articles:

The Reconstructed Conemaugh Arch Bridge 291

A Proposed System of Highway Bridge Supervision for the State of New York (*Concluded*) 291

Improved Upright Power Drill 292

A Detroit Report on Street Pavements 292

The True Norwegian "Ski" 293

Brick Pavement Specifications for Nebraska City, Neb. 293

The Trans-Atlantic Cable Lines 294

Design for Grand Stand at Monmouth Park, N. J. (*with Inset*) 295

Foreign Highway Construction and Maintenance (*Continued*) 295

The Jungfrau Railway 296

The Webb and Thompson Staff Apparatus 297

New Signal Plant on the Central R. R. of New Jersey 297

New Types of Valves and Fire Hydrants 305

The Final Inspection Report on the Forth Bridge 305

More About Cement Barrels 306

Tests of a Steam Excavator 306

Personals, Publications Received, Trade Publications, Society Proceedings 298, 299

Editorial Notes and Editorials 300

A Complicated Crossing—Railroad Commissioners' Decision on Lake Shore Disaster—Colorado Cañon Railway—New River Water-Works, London—Columbus Quadri-Centennial Celebration on Watling Island—Naval Engineers in England.

The Chicago Exposition Building 301

Notes by Rail (*Editorial Correspondence*) 302

Correspondence 303-305

Bouscaren's Specifications Corrected—The Horizontal Stadia Rod—Revolution Indicating—Aluminum Transits—Vertical Curves—The Skew Portal Problem—The Jenson Design for the Chicago Exposition Building—The Proposed Quadri-Centennial Celebration of the Landing of Columbus.

Railways, Rapid Transit, Highways, Water-Works, Bridges, Tunnels and Canals, Electrical, Sewerage and Municipal, Contracting, Proposals Open, Manufacturing and Technical 306-312

ENGINEERING NEWS.

THE MERCHANTS' BRIDGE, across the Mississippi river at St. Louis, is to be formally opened to traffic on May 1, next. Accompanying the formal invitation to this opening is a copy of the correspondence giving the official history of the bridge. From this it can be briefly stated that during 1885 and 1886 several bills granting franchises for a bridge were submitted to the St. Louis Merchants' Exchange for their endorsement. Not knowing in what interest these bridges were to be built, the Exchange declined their approval; and on March 25, 1886, the Board of Directors were advised by the Transportation Committee of the Exchange to apply to Congress for a franchise in the name of the Merchants' Exchange. But as the charter of the Exchange would not permit it to construct and maintain a bridge, the directors selected 13 citizens to act as grantees and trustees for the Exchange; it was then discovered that Congress would not grant a franchise to individuals and no further official action was taken by the directors. Individual members of the Exchange did, however, incorporate as the St. Louis Merchants' Bridge Co., obtained the franchise and built the bridge. This company in announcing its organization in 1887 to the Exchange was told by the directors of that body to go ahead and they, the Exchange, "would give them all the assistance in its power." The incorporators now notify the Merchants' Exchange that, while it was prevented by law from acting in its corporate capacity, it is still regarded as the originator of the bridge, and as such is asked to take part in arranging for the formal opening.

THE HARLEM RIVER BRIDGE HEARING, held before Lieut. Col. GILLESPIE, U. S. Engineer, is closed. Col. GILLESPIE is reported to have found the Third Avenue bridge an obstruction to navigation; it is only a question of degree, to be decided by an official board of inquiry. Chief Engineer KATTE, of the N. Y. Central Ry. exhibited a plan of a new bridge for Fourth Avenue, which he says his company would build; it provides for 80 ft. openings and a height of 4 ft. 8 ins. above springtide as at present. The opposing counsel wanted 100-ft. openings and a clear height of 24 ft.

THE NORTH RIVER BRIDGE PROJECT, on the plan of Mr. GUSTAV LINDENTHAL, C. E., has been reported upon favorably by the House Committee on Commerce at Washington. This report includes the clauses before noted, requiring plans to be submitted to the Secretary of War for his approval, and the increase of headway from 135 ft. to 145 ft.

THE FORTH BRIDGE "BALE OF COTTON," that caused the first "accident" on that structure, is made the text of an editorial by the London *Railway Press*. The conclusion arrived at is that it is about time for English railway managers to commence using box-cars for goods of such a character that they are liable to be blown off of the open trucks employed in England. The *Press* says that it expects its suggestion to be met by the usual remark—"Our company has gone very closely into American methods, and finds them quite unsuitable to English lines."

THE RAILROAD SPEED QUESTION IN CHICAGO comes up again in the form of a substitute ordinance introduced by Mayor CREGIER. The ordinance is a long one, in nine sections. It fixes the maximum rate of speed within the limits of Chicago for passenger trains and single engines at 20 miles per hour in the first or inner district of the city; 25 miles in the second, and 30 miles in third or outer district. For freight trains the speed is to be 6 miles; in the second 9 miles, and in the third 12 miles. The ordinance defines the limits of the three districts. Another section prescribes that all companies shall board their tracks by substantial walls or fences, and erect and maintain gates, signal towers, etc., and must be responsible for legal damages arising from such structures. The ordinance is made a special order for next week.

THE FOLLOWING TENDERS for railway material in GERMANY were the lowest received by the Royal Prussian Ry. (Left Rhine) authorities: Aachener Hütten Actienverein, Rothe Erde, for 2,000 tons steel rails at $48; for 1,200 tons cross-ties at $37; for 220 tons fish-plates at $45; Stumm Bros., Neunkirchen, for 340 tons cross-ties at $37. Prices are per 2,200 lbs., and at the respective works.

THE RAILWAY QUESTION IN CHINA is still a live issue. The viceroy, CHANG CHIH-TUNG, recently appointed to Wuchung, has secured the services of two English and two German mining engineers to investigate the feasibility of obtaining native ore and building works for the manufacture of iron and steel, as it is his idea to have the work done as far as possible by Chinese money, material and labor. He has also engaged Mr. SCHEIDTWEILER, an engineer who has been for two years attached to the German Legation at Peking, to make a preliminary survey of the proposed line from Peking to Hankow.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a head collision March 22 near Portage, N. Y., between a passenger train and a freight train on the Western New York & Pennsylvania R. R. Both engines and several freight cars were wrecked. Three persons were killed and five or six were injured. The accident is said to have been due to wrong orders given to the engine driver of the freight train by the operator at Rossburg, who should have held the freight at Portage.——Two freight trains on the Old Colony R. R. collided March 22 at Concord, Mass. The wreck caught fire and several cars were burned.——An east-bound passenger train on the Northern Pacific R. R. was wrecked March 25 at Noxon, Idaho. Several cars were burned. Eight persons were injured and one killed.

THE BOILER OF A LOCOMOTIVE on the Fitchburg R. R. exploded recently while the engine was standing in the yard. The dome was blown off and the engine overturned. Two men were injured.

BRIDGE AND TRESTLE ACCIDENTS are reported as follows: March 21, a freight train went through a trestle on the Georgia Pacific R. R. near Cordova, Miss. One man was killed and six were injured. ——The lower iron bridge across the river near Bridal Veil Falls, in the Yosemite Valley, Cal., has fallen.——Two bridges near White River City, Colo., have been washed out.

THE FLOODS IN THE MISSISSIPPI AND OHIO continue. At Cincinnati the water approaches the 60 ft. mark; which is well below the 66 ft. 4 ins. of 1883, or 71 ft. of 1884. The flood is supposed to have reached its limit there. Covington and Newport, on the Kentucky side of the river, are inundated to a considerable extent; 200 houses are flooded out in Newport. On the Mississippi, the situation is little changed from last week. Another levee has broken at Arkansas City, and the break at Greenville is still unclosed. The water had fallen 10 ins. at New Orleans on March 24.

THE WASHINGTON TUNNEL CONTRACTORS, Messrs. Beckwith & Quackenbush, have entered suit in the Court of Claims for $233,303.62. They had previously, on March 9, stated that the government owed them $180,000 at that time, and they were willing that there should be deducted from that sum the amount necessary to make good the tunnel lining, reserving the question of liability prior to Dec. 5, 1887. They formally protested against visiting upon them the defects inherent in the tunnel scheme. They also promised to make good the defects prior to Dec. 5, 1887, provided the government agreed to reserve for legal decision the question of their liability. The contractors gave ten days for this decision, but legal points delayed the Secretary of War in his answer and the suit was brought.

SECTION 3 OF THE NEW CROTON AQUEDUCT is reported by Chief Engineer FTELEY as completed according to contract. This is on the Brown, Howard & Co. contract. The hearing on the O'Brien & Clark bill to expedite the settlement of disputed aqueduct claims is before the Senate Judiciary Committee.

THE PROPOSED SCHUYLKILL LEASE, for an additional water supply to Philadelphia, has been passed upon by the City Solicitor of Philadelphia, Mr. WARWICK. The opinion is a lengthy one; but the conclusion reached is that the water company has not acquired an ownership in the property of the Schuylkill Navigation Co. sufficient to justify the city in executing a lease. Mr. WARWICK, however, admits that Philadelphia cannot acquire a full and unrestricted use of the waters of the Schuylkill River as long as the Schuylkill Navigation Co. asserts its charter rights in the river.

THE DONCASTER, ENGLAND, AUTHORITIES have the option of buying the coal underlying their water works reservoir, or of taking the consequences of a surface settlement of about 3½ ft. The Corporation does not want coal that cannot be mined, and hence conclude to take the chances; especially as their engineers say that the subsidence will probably be so very gradual that it may not destroy their reservoir after all.

A DYNAMITE MAGAZINE FOR HOT COUNTRIES is illustrated in *Indian Engineering* for Feb. 8. It is designed for use in India, by Mr. JOHN HARRIS, dynamite instructor to the Nobel's Explosive Co. It is a brick structure 13×24 ft. on plan, 15 ft. high, with an arched roof 15 ins. thick, and a 6-in cement floor. The walls of the building are 18 ins. thick, with but one end window and one door opening into a vestibule 10×16½ ft. in plan. The boxes of dynamite are piled on teak-wood benches. On two sides of the building are two tiers, of three each, of ventilators 8 ins. square, and covered with an iron grating. To prevent any mischief being done through these ventilators they are Z-shaped in the section of the wall, the opening inside being nearly 3 ft. above the outside opening. A lightning-rod at each end of the building terminates in a 3×3 ft. ×⅛ in. copper ground-plate. The doors and the one shutter are made of ¼-in. wrought iron with iron frames, so that the building is absolutely fireproof.

THE JUSTIN DYNAMITE SHELL, lately tested by firing 19 lbs. of dynamite, with 35 lbs. of powder, in a shell weighing 350 lbs. in total, is thus decribed by the Syracuse *Standard*:

The missile is a combination of two shells, one suspended within the other. The inner shell has no metallic connection with the outer one, and it is as free from taking any vibration from the latter as though suspended in mid-air. The inner shell is an ordinary piece of wrought brass tubing one-half the length of the outer shell and having a thin steel cap at either end. Wooden boxes containing two and three pounds of dynamite each are alternately placed in the tube. The steel caps are then screwed on and the inner shell wrapped in asbestos packing. The caps are furnished with leather air cups, one on each end,

making the inner shell air-tight when placed in the outer shell, save that pierced through these air cups are vents through which the air in the head of the shell slowly escapes, allowing the tube containing the dynamite to run slowly down to the point, where it is held in place by a small steel wire fastened over a sharp-edged bearing. This leaves the rear half of the big shell entirely empty, save of air. The shell is then complete and ready to be discharged from the gun. When the shell is thrown the small steel wire is snapped in twain. The inner shell goes unexploded to the rear. The air in the back chamber, forming an air cushion, being displaced through the vents in the leather air cups, rushes in the space left in the forward end by the inner shell as it works backward. The secret, as may readily be seen, lies in the fact that the inner shell is free to move backward and forward slowly, and being free from metallic connection with the outer shell is not subject to the vibrations caused by the explosion of the powder behind it. The point of the shell, though heavily weighted to insure a perfect balance when the shell containing the dynamite is at the rear, is of very thin metal and is easily broken when it strikes any resisting substance. The smashing in of the head explodes the dynamite.

THE TORPEDO BOAT "CUSHING" made its official speed trial on Mar. 24. During a 3 hours' run she made the full 22 knots required by the government, though the exact and full speed record has not yet been published by the officers conducting the trial. The trial was made with raw firemen and of course new machinery, and it is believed that better time can be made.

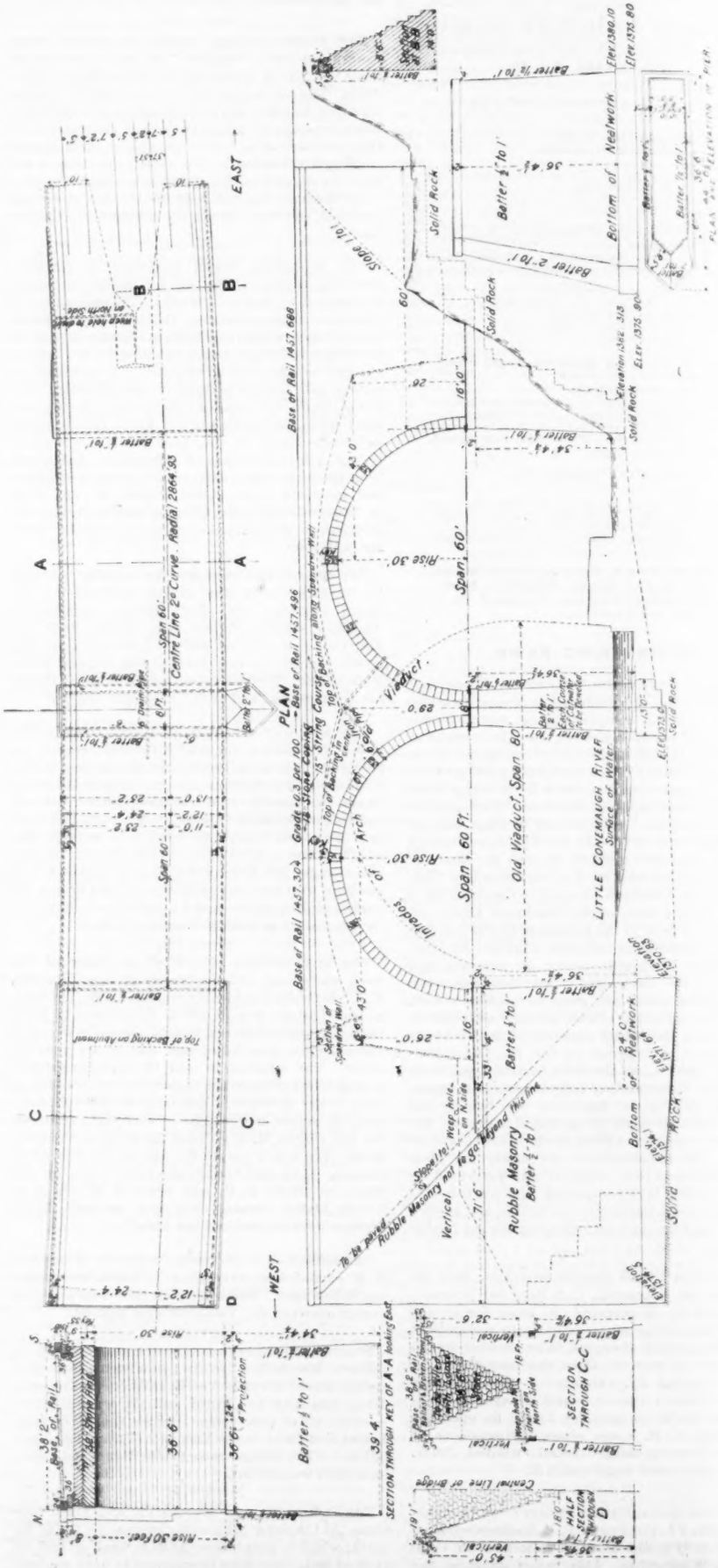
Mr. JOSEPH FRANCIS, the inventor of the metallic life-boat and life-saving car, is to be at last honored by his own government with a gold medal for his inventions. Mr. FRANCIS is about 87 years old, and introduced his life-boat to public notice in 1825. Years ago Mr. FRANCIS had honors conferred upon him by NAPOLEON III., the Emperor of Austria, ALEXANDER II., of Russia, and received medals and diplomas almost without number. President HARRISON is now to present him with a gold medal, 4½ ins. in diameter and ¼ in. thick, weighing about 4 lbs. As usual, our government is tardy in recognizing the inventions and discoveries of its citizens.

THE CONSTRUCTION OF FURTHER ELECTRICAL SUBWAYS in this city is still delayed. The decision of Judge ANDREWS must be received before the Board of Electrical Control can award contracts to the Standard Co. At the last meeting, Public Works Commissioner GILROY was very emphatic in announcing his determination that the subways must be put down before the new street paving is commenced. Mr. GILROY again stated that it was absolutely impossible for his, or any other, department to keep the streets in repair as long as these very numerous applications for opening streets keep pouring into his office. He suggested subways under the sidewalks, but was met with the objection that the numerous vaults located there would interfere.

PAVING GRANITE TESTS have been recently made on a considerable scale by City Engineer R. T. SCOWDEN, of Louisville, Ky. The tests showed that granite from quarries near Bethlehem, Pa., Little Rock, Ark., Columbia, S. C., and Lithonia and Conyers quarries of Georgia, are fully equal to the famed granite of Richmond, Va. One block of the Lithonia granite withstood a pressure of 80,700 lbs. per square inch without crushing; and Conyers quarry granite stood 81,700 lbs. without crushing. The Arkansas and Bethlehem granites withstood tests equal to the last.

THE BRAZOS JETTY, says the Houston *Daily Post*, is now out 3,800 ft. from the shore, leaving about 1,000 ft. to build on each jetty. The present rate of progress is 80 ft. per day. As described, the width between the jetties is 600 ft., reduced by wing-dams in places to 300 ft. In construction the east jetty is kept about 100 ft. in advance of the west, and the drift deposited by the prevailing south and east winds is deposited west of the west jetty, so that a person can walk dry-shod on this deposit at low tide to within 150 ft. of the end of the jetty.

THE CITY OF MEXICO DRAINAGE TUNNEL, some 9 miles long, is said to have already had $1,000,000 invested in plant alone. The firm of Read, Campbell & Co. say that if sufficient labor can be had, the tunnel can be finished in 18 months. The shafts will be sunk along the whole line of the tunnel in about 5 or 6 months, say our Mexican exchanges.


PLAN
EAST
WEST
Span, 60'
Rise 30'
Old Viaduct, Span 60
Span, 60 Ft.
Viaduct
Arch
Intrados
Rise 30'
Rubble Masonry
Batter ½ to 1'
Batter 2" to 1'
Solid Rock
Bottom of Keelwork
LITTLE CONEMAUGH RIVER
Base of Rail 1437.688
Base of Rail 1437.496
Base of Rail 1437.304
Grade +0.3 Per 100
Centre Line 2d Curve Radial 2864.93
Span 60'
Top of Backing
Stone Coping
String Course
Section through Key of A-A looking East
SECTION THROUGH C-C
SECTION THROUGH D
HALF SECTION THROUGH D
Rise 30 Feet
Centre Line of Bridge
To be paved
Vertical
Keep hole on N side
Keep hole on North side
Section of Spandrel Wall
Top of Backing on Abutment
Elevation 1380.10
Elevation 1375.80
Elevation 1375.90
Elevation 1362.3/8
Elevation 1360.33
Elevation 1360.83
Elevation 1370.6
Elevation 1370.6
Elevation 1370.6

The Reconstructed Conemaugh Arch Bridge.

We illustrate this week the plan of the new arch bridge over the Little Conemaugh River, built to replace the arch carried away by the breaking of the Johnstown dam last year. The old 80 ft. single arch is shown in dotted lines on the elevation; but this has now been replaced by two 60 ft. arches separated by a pier 8 ft. thick at the spring line. The left-hand abutment has also been carried to the bed-rock, instead of stopping at what is marked on the elevation as "bottom of neat work," as did the foundation of the old arch.

Owing in part to the original failure to found on the rock, the masonry and all the deposit of gravel below it was scoured out to the rock-bed, when the old arch failed under the wave from the Johnstown dam. As the old viaduct was honestly built and dammed back the water to a height of nearly 60 ft. for an unknown length of time, it is just possible that had the old work been carried to the rock originally it would have stood for a longer time still, until the arch had permitted sufficient water to escape to lower the head and reduce the strain upon it, and, perhaps, have thus survived the flood.

As it is, the destruction of the old arch made necessary some very costly temporary work to carry the tracks of the Pennsylvania R. R. over the gap, work that was erected in a marvelously short time, as then detailed by this journal. The arches, however, provide a much more ample waterway against any future contingency, and are in themselves noble specimens of stone masonry in keeping with the rest of the numerous stone arch bridges built on the line of this road. We are indebted to Mr. WM. H. BROWN, Chief Engineer of the Pennsylvania R. R. Co., for the original plan from which our illustrations are made; the dimensions, etc., are sufficiently clearly indicated on these without further description.

A Proposed System of Highway Bridge Supervision for the State of New York.

BY CHAS. F. STOWELL, M. AM. SOC. C. E.

(*Continued from page 260.*)

In 1873, a committee consisting of the members of the American Society of Civil Engineers was appointed to report the most practical means of averting bridge accidents. The immediate occasion of the appointment of this committee was the fall of Dixon, Ill., bridge. Seven members of the committee presented four reports. As regards highway bridges, it was generally agreed that the society should establish a standard of loads for different classes of bridges, though there was some difference of opinion as to what the standard should be. Four of the committee thought the adoption of the standard of the society should be made compulsory, while three others thought the opinion of the society would have more weight if not backed by legal authority.

Two members thought that the best way to secure to the public the full benefit of the adoption of such a standard would be to provide by law for the appointment by the governor of each State of an expert to look after the bridges in the State, and who should be obliged to pass an examination as to his qualifications and fitness by a standing committee of the society appointed for that purpose. But the others thought this was going too far, and, though agreeing that the society ought to fix the standard of loads and unit stresses, still thought that enlightened public sentiment would compel the general adoption of the society's standard without legal compulsion. But sixteen years' experience shows that enlightened public sentiment exhibits little tendency in that direction.

The plan of placing the supervision of highway bridges in the hands of one person appointed by the governor and subject to confirmation by the Senate seems best suited to the needs of New York. The work is of such magnitude that the creation of a separate bureau for it would be advisable if not essential, and it is highly desirable to concentrate the authority and fix the responsibility of such a bureau in a single person. It will be objected that such a bureau will degenerate into a mere political machine; but this objection is applicable as well to any state office whatever. Similar bureaus for the supervision of other kinds of business, as, for instance, banking and insurance, have, as a rule, worked satisfactorily. Politics must necessarily always enter into the administration of every public office in this country, but it has rarely happened in any New York State bureau that public business has been subordinated to politics to any injurious extent, while in those bureaus whose heads are subject to executive appointment, politics generally holds a much less important place than in those whose heads are elected directly by the people.

A bureau to regulate bridge construction should of course be in charge of an expert of acknowledged integrity and ability, whose compensation should be sufficient to enable him to devote his whole time to it. If properly done (and it would be worse than useless to attempt any half-way measures) the work of the bureau would require the whole time of such an expert, and he should have such clerical help as he might require and perhaps occasionally expert assistance also. To require that such an expert be a member of or endorsed by the American Society of Civil Engineers would be unwise. It is contrary to the genius of the American people to restrict the selection of candidates for office to the members or to those endorsed by any particular society. Moreover, although most of the prominent bridge engineers of this country are members of this society, still it by no means follows that no competent man could be found outside of it and still less that in all future time every competent bridge engineer will be a member. Neither is it a function of the society to examine candidates or certify to their fitness. The society is not a bureau for supplying candidates for public offices and it cannot afford to divide with the governor or other appointing power the responsibility of filling such offices with proper persons. Any connection, however remote, with state politics will certainly injure the society.

The official thus appointed should be required to supervise generally the construction and maintenance of all highway bridges in the State except those belonging to the State and which are controlled by another department, those belonging to railroad, turnpike or bridge companies, to firms or individuals, and those not on public highways. He should be required to inspect at stated intervals all bridges, either in person or by deputy, and should keep on file corrected plans of every bridge within his jurisdiction. He should be empowered whenever he considers a bridge unsafe to require the local authorities to put it in safe condition, and at his discretion to close it to public travel until it is made safe. Whenever a new bridge is needed he should designate its general dimensions and the moving load, and furnish specifications, or, at his discretion, specifications and plans for its construction. It should be obligatory with the local authorities to advertise for sealed proposals or proposals and plans for the construction of every bridge, which having been received should be referred for examination to the State official, who should certify whether any of them did not comply with the specified requirements, and such bids, if any, should not be considered in awarding the contract. The letting of the contract should be left entirely in the hands of the local authorities, but before the bridge is commenced detail plans should be filed with and approved by the State officer, and after it is finished he should certify to its agreement with the specifications and plans before payment for it could be demanded.

It will be seen that the aim in this plan is to retain in each community the right of local self-government as regards the awarding of contracts and all other purely business details, while the State is to supply such expert assistance as is necessary to guarantee a safe bridge, and which the local authorities very rarely obtain of their own volition. The interference of the State would only be sufficient to secure for each bridge (*a*) proper specifications, or specifications and plans, uniform for all bidders, (*b*) the letting of contracts upon sealed proposals after public advertisement, (*c*) the agreement of the finished structure with the plans and specifications filed with the State, and (*d*) the inspection of all bridges by a competent person at stated intervals. It is believed that this plan would at a moderate expense form a reasonable guarantee of the safety of all public highway bridges, inasmuch as it would cover all the points of engineering supervision except mill, shop and field inspection during the progress of the work, and which is a business that the State could hardly be expected to undertake. But the plan would, of course, in no way interfere with any inspection or additional supervision which the owners of a bridge might wish to have. The plan ought to find favor with all reputable bridge builders, inasmuch as all bidders would be placed on an equal footing, and it would no longer be necessary to incur the very serious expense of having an agent attend every bridge letting in person and often spend many days previously or subsequently in "working up" the highway commissioners.

The following draft of a bill is suggested to cover such a plan as that outlined.

An act to regulate the building and maintenance of highway bridges:

SECTION 1. There shall be in and for the State of New York a Superintendent of Bridges who shall be appointed by the governor, subject to confirmation by the Senate, and shall hold office for the term of five years from the date of such confirmation. He shall be a practical civil engineer, skilled in the theory and practice of bridge building and of not less than 10 years' experience in such business. He shall not be interested either directly or indirectly in any manner whatever in any work or contract for the building or repairing of any highway bridge in New York State during his term of office. He shall have general charge of the building and maintenance of the superstructure of all highway, road and street bridges, except such as are hereinafter exempted from the provisions of this act, and shall receive as compensation the sum of —— dollars per year, payable monthly. He shall not be engaged in any other business or avocation during his term of office.

SECTION 2. Whenever it may become necessary to build any new road or street bridge, or to make repairs to any existing bridge involving the changing or renewal of any parts other than the hand rail, planking or wooden joists, the highway commissioners or other local authorities having charge of the work shall notify the Superintendent of Bridges, who shall thereupon furnish specifications for the work to be done, and in the case of a new bridge shall fix the moving loads for which the bridge shall be designed. He may also at his discretion furnish plans for the proposed work. If the proposed work is estimated to cost three hundred dollars or over, sealed proposals for performing it shall be invited by public advertisement in at least three newspapers published within the State for not less than four weeks prior to the letting of the contract, one of the newspapers to be designated by the local officials having charge of the work and the other two by the Superintendent of Bridges, who, at the expiration of the time, stated in the public advertisement, shall open them and examine them to ascertain whether there are any which do not comply with the specifications or specifications and plans, and such bids, if any, shall be marked informal. The bids shall thereupon be transmitted to the highway commissioners or other local authorities having charge of the matter, who shall award the contract to such bidder as they choose, rejecting, however, all bids which may have been pronounced informal by the Superintendent of Bridges.

After a contract is awarded, and before the work is commenced, full detail plans shall be submitted to and receive the written approval of the Superintendent of Bridges, and a copy of such plans shall be filed in the office of said Superintendent o Bridges.

After the work has been performed under such a contract, and before payment therefor has been made, the Superintendent of Bridges shall examine the work to ascertain whether it complies with the specifications or specifications and plans furnished by him, and with the detail plans filed as heretofore provided, and if so he shall give to the contractor a certificate to that effect. No town board or other auditing board, officer or officers shall audit any claim for payment for work done under the provision of this act, unless there shall be attached thereto such certificate of the Superintendent of Bridges.

Whenever any piece of work covered by the provisions of this act is of a less estimated cost than $300 the contract may be awarded without public advertisement, but all the other requirements specified for work of greater cost shall be fulfilled.

SECTION 3. It shall be the duty of the Superintendent of Bridges to make and keep a correct list

of all highway or street bridges in New York State, with a description of their length, width, material, date of construction and general condition, and for the purpose of making and keeping such a record all highway commissioners, or in their absence the supervisors of towns, and city engineers, or surveyors of cities, or other local officers having charge of public bridges, shall furnish the Superintendent of Bridges with such information as he may require.

It shall be the duty of the Superintendent of Bridges to visit and inspect each and every highway or street bridge in New York State at least once every two years and as much oftener as he may deem it necessary. Whenever in the judgment of the Superintendent of Bridges it is necessary to rebuild or repair any bridge to render it safe for public use, he shall so notify the local officers having charge of the same, who shall thereupon proceed with such repairs or renewals in the manner hereinbefore specified, and until such repairs or renewals are completed the Superintendent of Bridges may, at his discretion, order such bridge closed to public travel.

SECTION 4. It shall be the duty of all highway commissioners and other officers having charge of highway or street bridges to provide and erect at each end of each and every bridge a sign not less than two feet square upon which shall be painted in letters and figures not less than four inches high the heaviest load which can safely be drawn over the bridge, which load shall be determined by the Superintendent of Bridges.

SECTION 5. The Superintendent of Bridges shall have power to deputize one or more competent persons either temporarily or permanently to perform any of the duties herein prescribed in case of the inability of said Superintendent of Bridges to perform said duties personally, either in consequence of physical disability or of his being otherwise engaged in the performance of his duties. The Superintendent of Bridges is also authorized to employ such clerical assistance as may be necessary in the performance of his duties. He shall be provided with a suitable office in the new capitol, and with the necessary office furniture for the performance of his duties.

SECTION 6. The Superintendent of Bridges shall report to the Legislature annually on the first Monday in February the condition of his department, a statement of the work done by it during the previous year, the expenses incurred thereby and a report upon any accidents upon highway bridges in New York State which may have occurred during the previous year, with the circumstances and causes thereof. The Superintendent of Bridges, his deputies and clerks, shall be repaid at the beginning of each month, upon the presentation to the comptroller of the proper vouchers, such sums as have been expended by him or them for necessary traveling expenses in the performance of the duties specified in this act. The total expense of this department shall not exceed the sum of —— thousand dollars in any one year, which sum for the current year is hereby appropriated out of any funds in the State treasury not otherwise appropriated.

SECTION 7. This act shall not apply to any bridge of less than 14 ft. clear span, nor to any bridge owned, maintained or operated by the State of New York, under the direction of the Superintendent of Public Works, nor to any bridge owned or maintained by any railroad, bridge or turnpike company, nor to any bridge owned or maintained by any corporation, firm or individual, and not on a public street or highway.

SECTION 8. All acts and parts of acts inconsistent with the provision of this act are hereby repealed.

SECTION 9. This act shall take effect immediately.

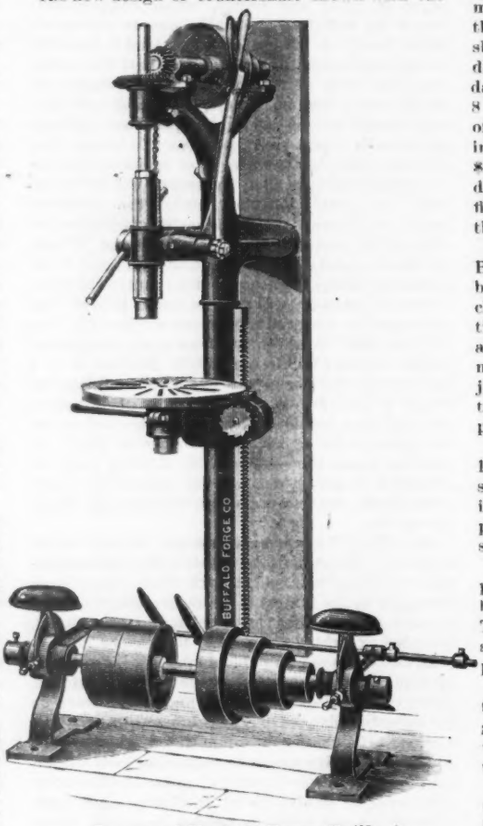
Improved Upright Power Drills.

The drills illustrated by the accompanying engravings represent two recently perfected examples of a large line of drilling machines for various uses made by the Buffalo Forge Co., Buffalo, N. Y.

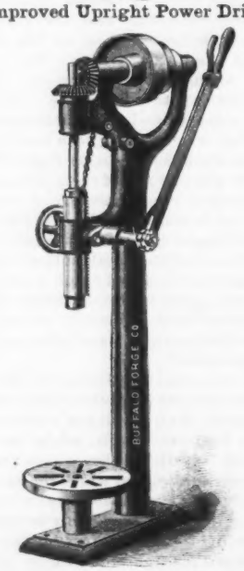
Both designs have machine-cut gears, running perfectly noiseless. The spindles take a ⅝ in. Morse taper shank, and will drill up to a 1¼-in. hole. The larger drill, designated as No. 87, will drill to a centre of 20-in. circle. A special attachment for carrying wheels when drilling the tire is afforded for the No. 87 drill, which is especially adapted and designed for the work of carriage and wagon makers, which feature is much desired by users of this kind of drill, as it greatly facilitates the work. This machine is arranged for four changes of speed, and is provided with adjustable table for raising and lowering to meet the demands of different classes of work. It weighs 320 lbs., and is 66 ins. in height.

The smaller drill, designated as No. 83, will drill to centre of an 11-in. circle, having three changes of speed. It is 50 ins. high and weighs 150 lbs.

The new design of countershaft shown with the



Improved Upright Power Drills.



large drill is adapted for tight or loose pulleys, and is made in suitable sizes for the smaller power drills. The bearings, which are in the ratio of 4 to 1, are solid, not babbitted, and bored out and reamed to gauges of cast iron, to increase their lasting qualities. It is also provided with a hanger and shipper arm all of one piece, which is regarded as a great convenience in putting up the hanger. The length of the countershaft is 32 ins., diameter of pulley 8 ins., and the drill should be run at 250 revolutions per minute.

All working parts of these drills are made from accurately fitted templates.

A Detroit Report on Street Pavements.

The City of Detroit is now deeply interested in the subject of the proper material for street pavements, and a special committee of the City Council has lately returned from an inspection trip to various cities and made their report, which in great part is as follows:

The committee found granite used as a street paving in Cincinnati (28½ miles), St. Louis (39 miles) and Chicago (11 miles). They ascertained that the hardest kinds of granite made a somewhat slippery pavement, and in Cincinnati were being discarded for a softer quality of granite. The foundation in each of these cities was composed of 6 to 8 ins. of concrete, the blocks being laid on a cushion of 3 ins. of sand. The cost of this pavement varies in the different cities. St. Louis and Chicago pay $3.52 and Cincinnati has paid as high as $4.50 for dressed Georgia block. All granite pavements are filled with an asphaltic composition so as to make them impervious to water.

They found Medina stone of two grades laid in Buffalo (133 miles), Cleveland (45 miles) and Columbus (7 miles). In Buffalo the specifications for first-class Medina stone calls for a 6-in. concrete foundation with a 2 or 3-in. cushion of sand. The blocks are of dressed stone nearly equal sizes, 7 ins. high, not less than 4 ins. wide and 6 to 8 ins. long. The joints are filled with asphalt cement. In the other two cities the specifications for first-class Medina pavement are the same.

For second-class Medina a foundation of from 8 to 10 ins. of sand is used in Cleveland, where the sub-soil is of a sandy nature, and 12 to 18 ins. of sand in Buffalo, where part of the sub-soil is of sand and part of the clay is loam, and the stone is of irregular sizes, and in most cases is filled in with sand.

The cost of the first-class Medina in Buffalo is $1 per square yard; in Cleveland, $3.50; and in Columbus, with a ten-inch broken stone foundation, $3.25. The price of second-class Medina averages $1.75 per square yard, and with asphalt filling costs 36 cents per yard more.

First-class Medina is a very durable and comparatively smooth pavement, and not being so hard as granite is not so slippery. It has been found to wear very evenly, and is especially adapted to heavy traffic.

The committee found brick as a paving material in use in Cleveland, Columbus and Decatur. Cleveland has made some experimental tests as to the wearing qualities of brick of various manufacture, but has as yet only laid one public street with this material. The tests were made by the City Engineer, and were as follows:

1. Absorption of water.
2. The grinding test.
3. The tumbler test.

Medina sandstone was taken as the standard. The absorption of water in 48 hours in Medina stone and a West Virginia brick, known as the "Porter Union," was the same and was scarcely perceptible. The grinding test consisted of placing the specimen on a grinding table, under a 50-lb. weight, and grinding them with sharp sand and water for three hours. The Porter Union brick stood this test very satisfactorily. The third and severest test consisted of weighing the samples and placing them in a tumbler 3 ft. in diameter together with 15 irregular shaped castings. The tumbler was then put in motion, revolving at the rate of 20 revolutions per minute, and was run for one hour. The largest pieces of each sample were then weighed and the percentage of loss noted. The result showed that the Porter Union was only slightly inferior to Medina stone. The Canton fire brick and the Hayden block did not withstand the test as well as the Porter Union.

The public street spoken of is Euclid place. It was paved with Canton, O., fire brick four years ago and is still in excellent condition, showing very little wear or disintegration. It cost $1.62 per square yard, and is laid on 12 inches of sand.

Several private streets in the residence portion of the city have been laid with brick, principally the Canton fire brick, and the pavement seems to have given good satisfaction. The price ranged from $1.35 to $1.75 per square yard.

In Columbus the committee found 21 miles of brick pavement, all of which had been laid within the last six years. The residents claim that seven years ago this was one of the worst paved cities in the country, and it impressed the committee as

being now one of the very best. The brick in principal use is what is known as the "Halwood block." It is made of a mica shale mined about 50 miles from Columbus, ground to a fine flour, sifted, mixed with water, pressed, dried and thoroughly vitrified by burning. This factory is located in the suburbs of Columbus, and cost $125,000, the owners being the Ohio Paving Co. The block is a large one, taking 45 to the square yard to 65 of the ordinary brick. The company have such confidence in the wearing qualities of this brick that they proposed to the committee to lay it in Detroit for $2.50 per square yard, with a ten years' guarantee on business streets and a twenty years' guarantee on suburban streets. This pavement is laid on a foundation of 8 ins. of broken stone, rolled with a 10-ton roller, and 2 ins. of sand for a cushion. The joints are filled with boiling pitch. The streets of Columbus are in excellent condition. No repairs whatever have been made during the six years in which brick has been used. The resisting power of the brick was shown to good advantage between the street car tracks, where it was subjected to the greatest and most constant wear. The price of brick paving in Columbus ranges from $2.25 to $2.50 per sq. yd., and includes a foundation of 10 ins. of broken stone.

In Decatur, Ill., the system of laying brick is entirely different and the cost much less than in Columbus. The brick is of ordinary size, 2 × 4 × 8, and the sub-soil is clay. Four inches of sand is laid, then a flat layer of brick, then a cushion coat of two inches of sand, and then the wearing surface, which is of vitrified brick, laid on edge. There are eight miles of this pavement there and not more than $50 has been paid out for repairs in the five or six years it has been laid. The first street was paved five years ago with the ordinary common hand-made brick, and even this is expected to last from two to three years longer, though the material of which it is laid is now discarded. The best pavement costs from $1.50 to $1.70 per square yard, with brick at $9 per thousand for selected brick and $8 for the average run.

The committee found asphalt in use as a paving material in Buffalo (61 miles), Columbus (10 miles), Cincinnati (6½ miles), St. Louis (4 miles), and Chicago (4 miles). This does not include a large amount of asphalt pavement on boulevards in Chicago under control of various park commissions. The present specifications for asphalt paving provide a 6-in. concrete foundation, a 4-in. tile drain under curb, and a 2½-in. wearing surface of asphalt composition. In Buffalo can be seen all kinds of asphalt pavement, from the best, which has lasted 12 years without repair, to the poorest, which has had to be repaired constantly since it was laid. One thing noticeable about asphalt pavement here is that it had all been paid for by the property owners in their petition; that they kept on asking for it on other streets, and that wherever it had been laid property has been considered more desirable and has brought higher prices when sold. There are here about 51 to 52 miles of very good asphalt, to which there seems to be but one objection--that of being slippery when covered with a thin film of ice. Asphalt pavement is laid here under a guarantee of five years, which, in some instances, has been extended to eight years. This kind of pavement has certainly done much to beautify Buffalo and make it an attractive city. One thing discovered to be desirable in the care of asphalt was to clean it with only a light sprinkling, as the use of too much water has a tendency to cause disintegration. Observations concerning asphalt in other cities showed substantially the same results; an appreciation in the value of abutting real estate and a tendency to beautify the cities in which it was laid.

The committee found no wood pavement in Buffalo, three miles in Cleveland, none in Columbus, two and one-half miles in Cincinnati, five miles in St. Louis, none in Decatur, 470 miles in Chicago. Cleveland had a considerable amount of wood pavement, and for the past 10 years has done little else in the paving line than to tear up the wood and replace it with Medina stone. Cincinnati has discarded the use of wood. St. Louis is putting down some cedar-block pavement, but on a concrete foundation. If this does not last the blocks will be taken up and granite substituted. All the pavement in Chicago was at one time of wood, but it was found to be unable to withstand the heavy traffic in the business districts, and much of it there has been replaced with granite. The large amount of wood pavement now in Chicago is laid in marked contrast to the system in vogue in Detroit. Some attention has been paid to the foundation, and the specifications call for either six inches of broken stone or four inches of sand and 2-in. hemlock planks. The blocks also are laid better, being filled with fine roofing gravel rammed in and filled with boiling tar. The result has been that Chicago has had wood pavements that have lasted with repairs from 5 to 12 years, according to the amount of traffic thereon.

The committee found macadam to be in use as a paving material in several of the cities visited, but the consensus of opinion seemed to be that while desirable for boulevards and park roads, it did not make a good city pavement.

As the result of their inspection the committee made the following recommendations for future street paving in Detroit:

Your committee are satisfied that no good pavement of whatever name or nature can be laid without a good foundation. They, therefore, recommend:

1. That no pavements in future be laid in Detroit without a 6-in. concrete foundation and 4-in. tile drain under the curb.

2. That all pavements except asphalt have not less than a 2-in. cushion coat of sand on the concrete.

3. That curb stones, whether of Medina or Berea stone be not less than 4 ft. in length, not less than 18 ins. in depth and 4 or 5 ins. in thickness.

4. That first-class Medina stone with filled joints be used on all very heavy traffic streets.

5. That asphalt be used to pave the main thoroughfares where the traffic is not too heavy, and on fine residence streets, and that brick be used on other residence and suburban streets.

6. That where wood pavement be used the joints shall be filled with fine gravel and cement, making the surface water-tight.

7. That Medina stone, brick or asphalt be used for all repaving.

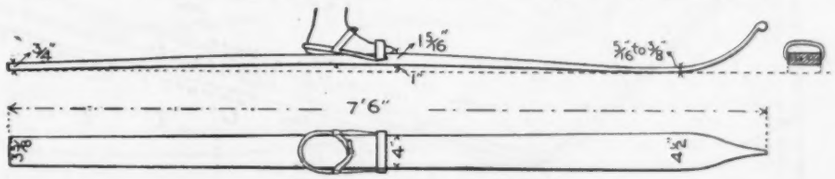
8. That no pavement of any kind be laid hereafter without a five years' guarantee.

9. That no paving be done on any street until all water, gas and sewer connections have been made, and that a proper ordinance to enforce this recommendation be adopted and strictly enforced.

The True Norwegian "Ski."

A correspondent, Mr. K. ZIMMER, of the Master Mechanics' office of the Lehigh Valley R. R. Co., sends us some interesting matter supplementary to our notes on the Norwegian ski published in ENGINEERING NEWS of Jan. 18.

The ski (pronounced "ske"), says Mr. ZIMMER, is noticed in Norwegian history as long as 800 years ago, and the ancient shape has been essentially preserved to the present day, as shown in the illustration here given, which is a scale drawing of the snow-shoe as now used in Norway. It is made of pine, ash or oak, and is used up to this day in conveying the mail from Kristiania to Bergen, when the coast mail steamers are detained by winter storms, as also in the mountain vallies where in winter the snow is too deep for other conveyance. As a means of traveling it is commonly used by all the peasants, men, women and children.



The True Norwegian "Ski."

Besides serving the useful purposes just referred to, it has developed into the most popular sport in Norway, and the Feb. 1 race on the ski is of akin in the interest excited to the English Derby. This race is generally attended by the royal family, the whole court, and many tourists from foreign parts.

The steepest hill near Kristiania is selected, and in the middle of the hill a "jump" is built up about 7 ft. high. The participants in the race come sliding down on their ski with a speed exceeding that of a railway train, and passing the "jump" they fly through the air for 75 ft. or more. The expert skaters land on their feet and continue the descent as if no interruption had occurred--the others don't.

The usefulness of the ski as an important factor in future Arctic explorations has been proven by the experience of Dr. FRITZJOF NAUSEN, who with five men made a trip on the ski through the interior of Greenland in the summer of 1888.

The *Mining and Scientific Press*, of San Francisco, in a late issue describes the snow shoe illustrated in our issue of Jan. 18, and adds some further matter of interest regarding its use in races in the Sierras. The *Press* says that these racing shoes are from 10½ to 13½ ft. long and from 3¾ to 4¼ ins. wide, with a ⅝-in. groove 1½ ins. wide on the bottom. The bottom of the ski is highly polished, and tar is burned and rubbed in until a full, mahogany-like finish is obtained, which hardens the wood, makes a smooth surface and attracts heat when exposed to the sun.

On the top of the shoe, a little back from the centre, there is about 18 ins. of wood left flat, and toward the front they are shaved and planed so as to leave the point springy. There is considerable wood left behind the centre as a counter balance, so that in running over rough places there will be no sudden jerk to endanger the equilibrium of the user. This is essential, as a speed of 60 to 80 miles per hour can be attained on these shoes, and they have a decided tendency to "buck" when going over uneven snow.

The bottom of the ski is lubricated, and the "dope" used for this purpose varies with the views of the racer and the condition of the snow; a soft dope for soft snow and a hard dope for frozen snow. This "dope" is made from all manner of ingredients; gum, beeswax, rosin, sperm candle, etc., will do for ordinary traveling; but for racing the ingredients vary much, and their compounding becomes more intricate; its manufacture is a "trade-secret" with the racer, as a rule.

The *Press* says that in racing, confidence is the first requisite; timidity is fatal. The racer rides very low on the shoes, in a "squatting" position with the brake pole in the right hand. The racing track is usually from 1,000 to 2,000 feet long, with slopes of 15° to 35°, but must lie in a straight line. It is said that it is no unusual thing in these races to see the shoes continue the course alone, and the rider meanwhile make strange gyratory motions in the air in seemingly vain efforts to restore things to a normal condition.

Brick Pavement Specifications for Nebraska City, Neb.

The following specifications for street pavements are kindly sent us by Mr. A. F. NIMS, City Engineer of Nebraska City. They seem to us to be excellent in form, and they contain certain provisions and requirements not usual in similar documents, but which are calculated to save trouble and misunderstanding between the city and the contractors. The portions relating to the preparations of the sub-grade, and laying brick street pavement are given in full:

SUB-GRADE.—All grading must be done in strict accordance with the lines, levels and plans furnished by the city engineer.

The transverse shape of the finished pavement will be a segment of a circle, so large that the centre of the street shall be even with the top of the curb and 8 in. higher than the lowest point in the gutter, which shall be 1 ft. from the outer edge of the pavement, and this outer edge shall be 1 in. higher than the lowest line of the gutter.

The bed of the street shall be graded to the exact form that the finished pavement is to be, and stakes furnished by the city engineer.

The ground, after being perfectly dressed, shall be thoroughly tamped with an 80-lb. tamper, or rolled with a roller having not less than 250 lbs. weight per inch of length, as may be directed by the city engineer and the chairman of the Board of Public Works. All soft or spongy material, when required, shall be replaced with gravel or broken stone at the contract price per cubic yard for said material.

All surplus earth taken from the street shall be delivered to any place where the city engineer may direct, and when hauled a distance in excess of 1,000 ft. the contractor

shall be allowed 1 cent per cu. yd. for each 100 ft. so hauled in excess. No plow shall be used in the preparation of the sub-grade deeper than a line 4 in. above the base of ballast, and any earth taken out with a plow below such line may be required replaced with sand or gravel, at the option of the city engineer, without extra pay. In all places where filling may be required to bring the bed to the required height, it shall be done in layers not to exceed 9 ins. in depth, and thoroughly tamped, rolled or flooded, as may be required to insure a solid bed. Only such earth as is above the level of the centre grade of the street shall be paid for as extra grading. All other earth shall be included in the price paid for paving, including filling streets that are below grade to the proper sub-grade, when the earth is taken from the street that is to be paved; if borrowed elsewhere, it will be extra grading.

BALLASTING.—*Sand.*—Whenever sand shall be used as a base for paving material, it shall be clean river or bank sand, free from clay or loam, and shall be laid to a true crown in compact form to a depth of 6 ins., except where otherwise specified by the city engineer. The sand shall be raked into an even layer and the roller passed over the same twice or three times, and made solid to the entire satisfaction of the city engineer and Board of Public Works. The sand shall be gauged by a template conforming to the true crown of the street, unless otherwise instructed by the city engineer.

BRICK PAVEMENT.—On the surface layer of sand shall be placed a course of brick upon their flat, or 4 in. surface, and lengthwise of the street, care being taken to break joints, the same as when laid in a wall, and to be laid to a true line as far as practicable.

Upon this course of brick shall be spread dry, clean river sand, sufficient to entirely fill every joint, and cover the entire course to a depth of 1 in.

Upon said course of brick so covered shall be placed a course of brick edgewise and crosswise of the street, placing them close together and breaking joints as before specified, also to be placed true to line. At street intersections the bricks shall be laid at an angle of 45 degs. with the street, the top course to be laid at right angles with the bottom course.

The brick composing the top course shall be regular in shape and size, and of the very best and hardest selected brick, and must be made in Nebraska City, Neb.

They shall not be less in size than 7½ ins. long, 4 ins. wide and 2 ins. in thickness; nor more than 9-in long, 4½-in. wide and 2¼-in. in thickness.

The brick to be gauged and piled according to size dividing on ¼ of an inch. The brick to be laid in courses across the street, using the same size through each course. A proper amount of sand being used to bring the top of brick of less gauge flush with the pavement, and top course to be thoroughly rolled or settled by ramming upon a 2-in. plank 10 or 12 ft. long, moved successively over the entire surface and made to conform with stakes set by engineer, all broken brick to be removed and replaced with whole ones, which must be securely settled into position, and to the satisfaction of the city engineer and Board of Public Works.

The top course of brick to be thoroughly covered with sand carefully broomed in.

The edges of all pavements at intersections, alleys and all other places where stone curbing is not used shall be protected by a curbing made of sound white oak plank 3 ins. by 12 ins. set up edgewise, extending across the street or alley and held in place by white oak stakes 2½ ft. long, 2 ins. by 3 ins., driven back of the curbing and not more than 3 ft. apart. The price of paving must include all wood curb.

CURBING.—All curbing shall be of a good quality of sandstone or granite, the name to be specified in proposals. The stone to be cut in rectangular form, 5 ins. for business streets and 4 ins. for residence streets, and not less than 20 ins. in depth and 36 ins. in length, with a bevel of ½ in. on top. The edges and face of all curbing to be dressed smooth and even to a depth of 12 ins. below the top.

All curbing shall be of uniform thickness and depth throughout and free from seams.

No wedge shaped, warped or otherwise defective stone to be allowed.

All joints to be made close fitting and not to exceed one eighth (⅛) of an inch in width for at least a depth of 15 ins. below top. The curbs shall be set on not less than 8 and backed up with no less than 8 ins. in width of sand.

They must be settled to grade by means of a light curbing pounder weighing no less than 25 lbs. Curbing cut to a radius of 2 ft. shall be used at all street intersections and alleys and such driveways as directed by City Engineer.

All curbing, including corner blocks, shall be measured by the actual lineal feet along their outer and upper edge.

All grading necessary for the setting of the curb will be done by the contractor, and the same specifications will apply as those for grading for paving except the grading will only be of sufficient width to allow of the proper setting of the curb, and such width shall be determined by the city engineer.

CORNER BLOCKS.—All corner blocks shall be of good quality of sandstone or granite, cut in a form of quarter circle having a radius of 24 ins. and a depth of not less than 20 ins., to be dressed to a true and uniform surface, at least 15 ins. below top of block, and to be cut on straight sides so as to make a joint not to exceed one-eighth of an inch with the curbing.

Corner blocks to be used at street intersections, alleys, and at such driveways as may be directed by the city engineer and Board of Public Works.

MEASUREMENT.—The measurements of all paving shall be done upon the basis of square yards actually paved, and where any street railroad shall be laid a deduction of five feet for width of each track shall be made from the whole width of the street paved—except where spaces between the rails of such tracks shall be paved by the contractor under direction of the Board of Public Works and city engineer, in pursuance of the provisions of the contract.

The Trans-Atlantic Cable Lines.

From an advance proof of *The Dominion Illustrated* we take the accompanying plan of the various Trans-Atlantic cables, including those in operation and the proposed Canada-Atlantic cable, now before the British Parliament. The map itself is prepared by Mr. F. N. Gisborne, C. E., F. R. S. C., Chief Superintendent of the Government Telegraph Service, in Canada, who has also prepared a similar map showing the Pacific cable systems. The following table gives the date and length of the several Atlantic cables:

THE ANGLO-AMERICAN CO.'S CABLES.

Laid.	Between.	Nautical Miles.
A. D. 1873.	Ireland and Newfoundland	1,881
"	Newfoundland via St. Pierre and Cape Breton	293
		—2,174
A. D. 1874.	Ireland and Newfoundland	1,840
1873.	Newfoundland and Sydney, C. B.	343
		—2,183
A. D. 1880.	Ireland and Newfoundland	1,886
"	Newfoundland via St. Pierre and Cape Breton	360
		—2,246
A. D. 1869.	France and St. Pierre	2,648
"	St. Pierre and Massachusetts, U. S.	759
		—3,407

THE DIRECT UNITED STATES CO.'S CABLES.

A. D. 1874.	Ireland and Nova Scotia	2,423
"	Nova Scotia and N. Hampshire, U. S.	560
		—2,983

COMPAGNIE FRANÇAISE PARIS A NEW YORK.

A. D. 1879.	France and St. Pierre	2,242
"	St. Pierre and Cape Breton	188
"	St. Pierre and Massachusetts, U. S.	827
		—3,257

THE WESTERN UNION CO.'S CABLES.

A. D. 1881.	England and Nova Scotia	2,531
1882.	England and Nova Scotia	2,576

THE COMMERCIAL CO.'S CABLES.

A. D. 1884.	Ireland and Nova Scotia	2,350
"	Nova Scotia and New York, U. S.	841
		—3,191
"	Ireland and Nova Scotia	2,388
1885.	Nova Scotia and Massachusetts, U. S.	519
		—2,907

THE CANADA ATLANTIC CO.'S CABLE (PROPOSED).

A. D. 1890.	Ireland to Straits of Belle Isle, Can.	1,900

The representative expenditure or share capital of the foregoing companies is approximately as follows:

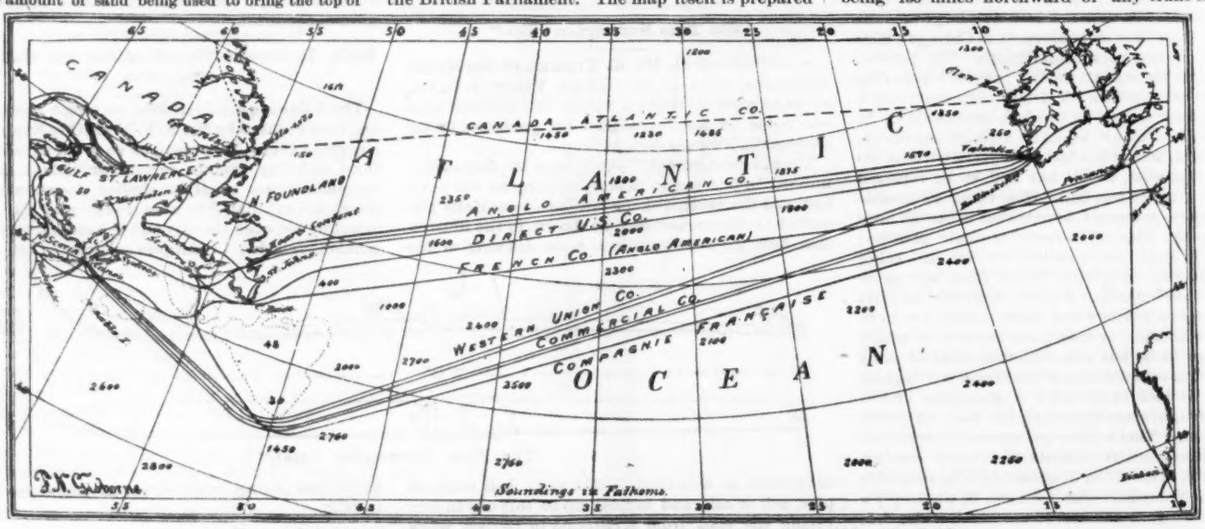
Anglo-American	$35,000,000	—Each line.		$8,750,000
Direct United States	6,400,000	"	"	6,400,000
Compagnie Française	8,000,000	"	"	8,400,000
Western Union	14,000,000	"	"	7,000,000
Commercial	8,000,000	"	"	4,000,000
Canada Atlantic	1,600,000	"	"	1,600,000

It is estimated that the *profitably* serviceable continuity of the foregoing cables will be 20 years for the older and 25 for the later types; last year's costly experience in repairing the Anglo-American French cable of 1869 is confirmatory of the former calculation.

Thus the three additional cables of the Anglo American Co. have a prospective existence of four, five and eleven years, respectively, and it is evident that the hitherto controlling power of the company *re* tariff and pooling dictation is an evil of the past.

The Direct United States Cable has yet a prospective profitable career of five years; the Compagnie Française ten years; thus the Western Union and Commercial companies, with their later cables of longer life, have control of the situation, as exemplified by the present established tariff rate of 25 cents per word.

The projectors of the Canadian Cable claim many advantages over the more southern lines now in existence. Chief among these are the claims that being 150 miles northward of any trans-Atlantic cable their line will be in shallower water and absolutely free from risks of repairs to other cables; the company will have no outlay for terminal cables; the capital required will not exceed $1,600,000, and it will cost but one-fifth of the older cables in price, and only one-third as much as the latest preceding cable. It is stated that the present number of trans-Atlantic dispatches relating to Canadian business number 800 per day and are rapidly increasing; and judging from the dividends paid on the inflated capital of the other lines, the projectors have no fear as to financial results.



Trans-Atlantic Cable Routes, including the Projected Canada-Atlantic Cable.

A LOWELL-BOSTON CANAL is being asked for from the Massachusetts Legislature, by parties seeking incorporation and power to dig it. The plan is to unite the Merrimac River at Lowell with Boston harbor at Medford.

Design for Grand Stand at Monmouth Park, N. J.

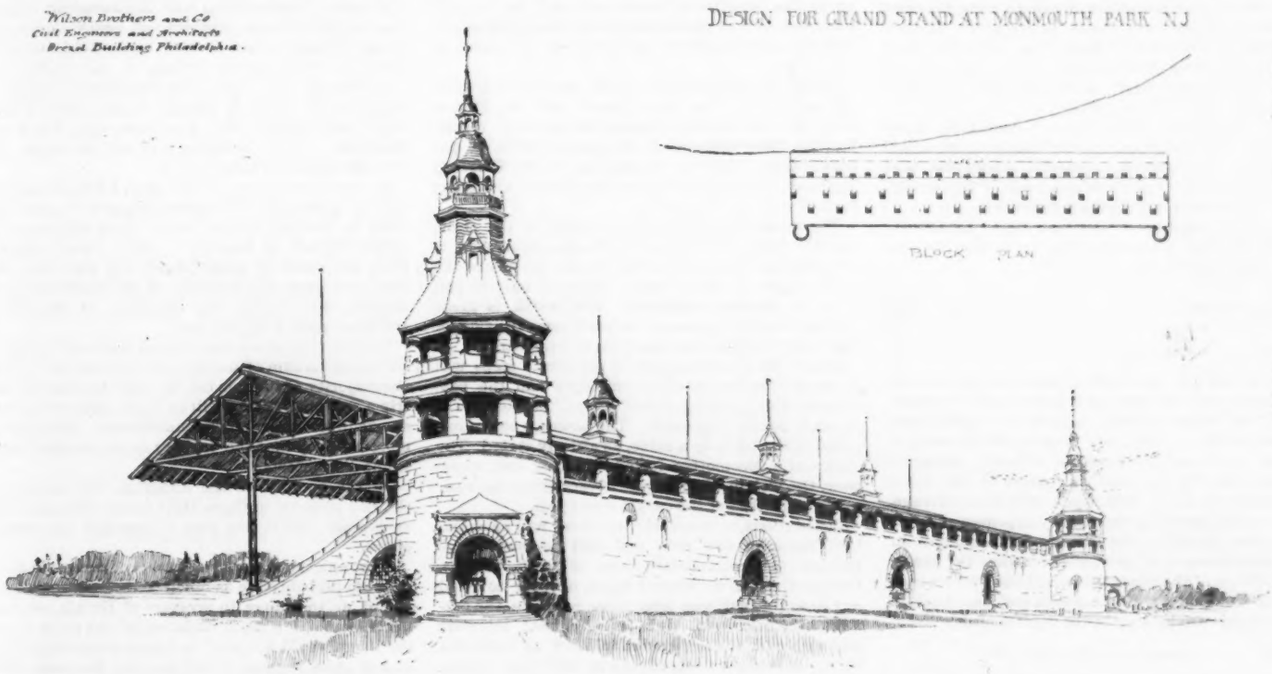
(WITH INSET.)

By inset plan and sections, and the accompanying general elevation, we illustrate a design prepared for the grand stand of the Monmouth Park Association by Wilson Bros. & Co., civil engineers and architects, of Philadelphia. This plan was submitted in December, 1888, but for some reason was not accepted.

In our issue of Jan. 18, 1890, will be found a design for the peculiar roof of this grand stand as actually constructed. It is carried out in its details, as there stated, by Mr. F. S. WILLIAMSON, C. E., "from suggestions made by Mr. D. D. WITHERS, the treasurer of the association." While the stand, as erected, exceeds considerably the roof dimensions of the plan of Messrs. WILSON BROS., it is evident that novelty in design cannot be claimed for it; and it must be left to our readers to judge for themselves where Mr. WITHERS obtained the original of his "suggestions."

The builders of the stand, the Wallis Iron Works, of Jersey City, obtained the contract in open competition, and their engineer, Mr. WILLIAMSON, simply put into working shape the suggestions of another party; hence they have not and do not claim originality for the roof design, and seek no further credit than that of having actually constructed the largest stand of its type in the country. On the other hand, Messrs. Wilson Bros. directly claim the large projecting roof as their own original design, presented to Mr. WITHERS for his approval a year before the letting of the contract for erection; and it is for Mr. WITHERS to explain whether or not he obtained his "suggestions" to the builders from this source.

Aside from the question of paternity, the design presented is a complete and very handsome one, in striking contrast to the sheds generally used for this purpose.


Wilson Brothers and Co
Civil Engineers and Architects
Bread Building Philadelphia.
DESIGN FOR GRAND STAND AT MONMOUTH PARK N.J
BLOCK PLAN

Design for Grand Stand at Monmouth Park, N. J.—WILSON BROS. & Co., Engineers.

Foreign Highway Construction and Maintenance.

(*Continued from page 246.*)

ITALY.—In the Kingdom of Italy the construction of public roads is generally undertaken by contracts, under the direction of the district prefects and the inspection of the Civil Engineering Department of the government. All of this falls under the authority of the Minister of Public Works.

Contracts are either sold at public lettings or given out by private arrangement; they include the entire construction and maintenance of the national highways. The contractor must furnish and transport his material; build the road, with all its masonry and iron work; remove snow, mud or dust, and care for the border trees and plants.

The contractor must deposit a fixed sum of money in the hands of the Board of Administration as "caution money." Contracts may be renewed from year to year at three months' notice, but they are generally dated from April 1 to March 31 in the succeeding year. He must furnish a surety before the contract is made out. When the road is completed and handed over in perfect condition and repair, according to the specifications of the contract, the contractor can be obliged to remedy any defects found within one month thereafter, or be made to pay the cost of requisite repair, as computed by the Chief Engineer of the district.

The "caution money" is returned to the contractor on his handing over the road in good repair. During the term of his contract he is bound to abide by the orders and requirements of the government engineers charged with the superintendence of roads. In case of neglect or refusal to perform work by the contractor, the prefect can cause the necessary work to be done at the contractor's expense; and a second offense of this class, or any act of fraud, entails the summary recision of the contract and the forfeiture of the caution money.

Work in excess of the contract does not entitle the contractor to increase of payment, unless it is done under a special arrangement and concession on the part of the government; and this concession must not exceed one-fifth of the annual payment for maintenance of the road. Damage to the road must be repaired by the contractor; but he is obliged to denounce the guilty parties and may proceed against them for the costs incurred.

Accidents to workmen arising from negligence or want of skill on the part of the contractor must be compensated for him by payment to the injured persons or their families. One per cent. of the payments due to the contractor are retained by the government to make due provision for such cases. The contractor is bound to keep a fixed number of hands at work on the maintenance of the highway.

Work and material supplied by the contractor will be paid for in advance by him, when necessary; but 6 per cent. is allowed to him on their cost as reckoned by a normal estimate. The Chief Engineer forwards in April of each year an estimate of the quantity of materials required for the maintenance of a road during the ensuing twelve months, and the contractor is bound to supply the same. One-half of the materials should be supplied during the month of March, and four-fifths must be ready for examination and verification before the end of June. One per cent. is deducted from payments for each day of delay. The duties of the contractor are clearly specified in considerable detail for every item of work in road construction and maintenance.

The contractor is bound to pay his workmen punctually every week, and to pay all bills for work or material within one week of presentation. In case of default of such payment 6 per cent. is charged against him by the government, instead of being added to the sums due him. The contractor is paid half-yearly, in October and April, by the Ministry of Public Works.

Special contracts are made in addition to the general contracts outlined above, for any excavation or embankment, drainage works, art work, etc., requiring some special arrangement. In these special contracts the exact measurements and every detail of the work are very minutely given, and the contractors are held strictly to these specifications.

In estimating for payment and cost of labor and material fixed rules are published, covering general and extraordinary cases. In these estimates measured work is valued according to actual results achieved, and plant and material on hand in the proper depots is estimated at one-half of the cost price. The definite amount of the caution money, or security retained, is ten per cent. of the net contract amount. The government officials are also controlled by strictly drawn-up regulations, and they must report monthly to the Department of Public Works on the cost and condition of the work in their charge.

The government road laborers, or *cantonniers*, are appointed by the prefects on the nomination of the Engineer-in-Chief of the district, and they also have their code of regulations. These laborers are selected for good character and honesty, must be of robust constitution, and the limit of age is 35 years. Preference is given to discharged soldiers and those who know how to read and write, or to the children of deceased or disabled cantonniers. They take an oath on entering the service, and are under the orders of the superintendents and engineers.

Each cantonnier must provide at his own expense

2 kinds of spades,	1 arm-badge,
1 shovel,	1 lantern,
1 pickaxe,	1 book of rules,
1 iron mallet,	1 iron ring,
1 mud-scraper,	1 work-and-wage book,
2 dust scrapers,	20 m. of cord,
1 hedge bill,	2 cylindrical 2-m. measures,
1 small bill,	1 rod with number on disk,
1 snow shovel,	1 blouse, 1 cloak, 1 hat, according pattern.
1 wheelbarrow,	
1 water can,	

The working hours are from sunrise to sunset, and in this time the cantonnier must go over the whole road apportioned to him; he is not permitted to absent or shelter himself more than he can possibly avoid, no matter what the weather may be. On feast days he merely visits the work to see that it is all right; but in cases of necessity he may be compelled to work even on feast days. He is allowed three hours' rest per day in summer, two hours in spring and autumn, and 1½ hours in winter; but he must not quit his work for the purpose of taking rest. In case of illness, he must notify the Engineer-in-Chief, and send a doctor's certificate if the illness lasts more than three days; after 15 days the absentee must furnish a substitute and contribute toward his payment; after three months another cantonnier is employed in his place.

The chief duty of the cantonnier is to level and repair the highway and to remove snow, mud and dust. He must also assist, without further pay, any traveler or vehicle in trouble on account of accident or bad weather, and has charge of the telegraph lines along the roads. Neglect of duty is punished by a fine of 40 cts. for the first offense, $1.00 for the second, suspension for the third, and dismissal for the fourth offense. At the end of the year the accumulated fines are either divided among the most deserving of the cantonniers, or are given to their provident associations, where such exist. The head cantonnier must have served three years and be able to read and write. These men receive at least $3.00 per month extra pay.

The State laws provide that a contractor must present with his tender "a certificate of his moral character," and also an engineer's attestation that he is competent to perform the work. The subletting of contracts is especially forbidden.

In 1878 (the date of the last report given) the length of roads maintained by the Italian Government was as follows:

	Miles.
National highways	4,880
Cross-roads	151
Total	5,031

The number of cantonniers employed at this date was 2,132, with 181 head-cantonniers and 7 "guardians;" the latter are kept only on the Alpine roads to care for the cantonniers' houses, which serve as shelter to travellers in these difficult mountain passes. In 1877 the cost of repairs to the roads amounted to about $100.80 per mile as an average. Beyond this sum, extraordinary expenses and subsidies paid yearly by the State to the communes for the maintenance of cross-roads makes the yearly expenditure of the State average about $240 for each mile of public road. Estimates of cost and detail of construction are lacking in the reports abstracted.

The Jungfrau Railway.

Herr R. BODER recently gave a lecture before the Austrian Engineers' and Architects' Association, on the various plans that had been proposed by reliable persons for building a railway to the summit of the Jungfrau. We give an abstract of the address, as printed in the *Wochenschrift* of the association.

Two projects have been worked out, one by M. KOECHLIN, the builder of the Eiffel Tower, the other by Herr TRAUTWEILER, who explained and defended his projects recently before the Aarau Engineers' Society.

The *Zuercher Zeitung* of Dec. 8, 1889, has a long article on the Trautweiler plan. From that journal, it would appear that Herr TRAUTWEILER considers the Jungfrau an easy mountain to climb as compared with other lofty peaks in Switzerland. The western face of the mountain is steep, and, if a railway ascended the peak on this side, few tunnels would be necessary. Moreover, the nature of the ground is such that the tunnels could be started in several points by driving auxiliary headings, and the labor of removing the material would be very light. The Jungfrau is the most celebrated mountain in the Bernese Oberland, and large numbers of tourists would probably visit the summit if a railway car would take them there. The mountain itself will protect the part of the railway passing through tunnels. The latter will have the smallest possible section in order to reduce the cost; probably it will be about 7 sq. m., or 75⅓ sq. ft. (the Gotthard tunnel has a 60 sq. m. section), which is large enough to allow the passage of a comfortable three-seated car. The line begins 3 kilos above Lauterbrunnen at the Stegmatten, 870 m. above the sea level, and ascends by four stages or sections, as a cable road, to within 100 ft. of the summit. The Schwarzer Monch and the Silberhorn will be pierced. In all, there will be 6,500 m. (4.03 miles) of tunnel, divided into four sections, between each of which a station is to be built. The first and steepest of these begins, as already mentioned, 870 m. above the sea level, and ascends with a *ninety-eight per cent.* grade to Stellifluh, 1,850 m. high; the difference in elevation between the ends of the first tunnel is, therefore, 980 m., the horizontal distance being 1,000 m. The second section has a 48 per cent. grade, is 1,840 m. long, and terminates at the Grab, behind the Schwarzer Monch, after having ascended to an elevation of 2,600 m. The third tunnel is 1,880 m. long, has a grade of 67 per cent., and ends near the Silberhorn, 3,639 m. above the sea. The fourth, 1,400 m. long, with an inclination of 33 per cent., leads to within 30 m. of the summit of the Jungfrau. The total difference in elevation surmounted by the line is 3,260 m. or 10,700 ft.

These figures are not entirely harmonious as regards the lengths of the sections and the heights ascended, yet the discrepancies are of small moment, and it would be of little value to seek the cause of the error.

It is to be seen that the second section with its 48 per cent. grade is to be compared with the Pilatus line; the third with a grade of 67 per cent., resembles the Ofner cable road; the fourth, with 33 per cent., approaches the maximum of the Gaisberg Railway. There is no line of 98 per cent. as yet, so far as Herr BODER is aware.

The tunnels are 2.90 m. (9.5 ft.) high in the clear, and are 2.70 m. (8¾ ft.) wide. The overhead arch is very flat and the nature of the stone in which the work is done is such that a lining of only 20 cm. (8 ins.) is deemed sufficient. The width is great enough to allow a person to walk near the side of the tunnel without danger from passing cars.

Where the grade exceeds 50 per cent., steps will be cut for the benefit of the employés and the passengers if an accident should occur. Accidents will be made nearly impossible. The power is communicated to the train by a cable, as already stated. The smoke of a locomotive forbids its use; and, moreover, the weight of an engine is very great as compared with that of the cars it could pull.

The stations between the sections will be chambers hewn in the rock, and will be made large enough to accommodate from 50 to 60 persons. Passages, closed by several doors, in order to avoid any draught, will lead from these rooms to the outside of the mountain. It is believed that travelers will stop over at each station in order to enjoy the view. It is almost superfluous to add that restaurants are to be connected with each station.

The track consists of two rails 1 m. apart with a rack between them, as on the Buergenstock. The gears engaging with the rack are for braking purposes. The cars are also fitted with brakes that will press against the tunnel walls, like the common elevator brake, if an accident happens.

The rails are carried on iron ties, which are bolted to the bottom rock when that is firm enough, otherwise to the tunnel walls.

The cars have three divisions or apartments, each containing six persons. They will be easy to build, and their appointments will be of the highest grade. Electric illumination will be provided and every care will be taken to make the trip an easy one. There will be a half meter clearance between the side of the car and the tunnel wall, on each side, so that there will be room enough for footways in addition to the track. In addition to these accommodations for pedestrians, large chambers will be cut in the side of the tunnel every 40 m.

The motive plant is the same as in all other cable roads, save that compressed air will be used in place of water. If water were employed to give to the descending car its excess of weight necessary for motion, it would have to be pumped to the top of the mountain from the lowest station, since none is to be had at the summit. Moreover, pipes for compressed air must be laid during the driving of the tunnel to furnish the power for drills, and economy would demand that these pipes be retained. The air is to be compressed 1¼ miles from the lowest point of the tunnel, at the Sefinenlütschine, and will be forced through 4 to 6-in. pipes.

So much for the Trautweiler project.

The Koechlin plan is to start at a point above Lauterbrunnen and ascend by the western slope, also. The line will be operated as a cable road, but the cars will be driven by water in the usual manner. This water is to be pumped up to subterranean cisterns, where it will be mixed with chemicals to prevent freezing. Most of the line will be in tunnels.

Although the technical details of this plan are meagre enough, the probable cost has been carefully calculated. This is placed at 8,000,000 fr., or say $1,600,000. Herr KOECHLIN estimates that one-third of the tourists visiting Interlaken in a year, 60,000 persons, will make the trip, so he has designed his line to accommodate 20,000 passengers. These will pay 36 fr., or $7.20, each for the round trip, which will allow a good dividend on the shares; It costs at least 300 fr., or $60, to make the ascent now, and only expert mountaineers can reach the summit.

Objections to both these plans came, almost as soon as the plans themselves, from meteorologists, physicians, and, strange to say, the Swiss Alpine Club. The principal points upon which the attack is directed may be summed up as follows:

Whoever is acquainted with the Jungfrau knows that no green alpine pastures and gentle slopes surround its head, where invalids (and cattle) can walk about in unnumbered throngs, as on the Rigi and the Pilatus. The top of the Jungfrau is a narrow ridge, where 10 to 15 persons might stand if they were very careful, and were absolutely free from dizziness. Who, however, will care to escort the average tourist to this place?

If Herr KOECHLIN counts upon 1,000 persons per day on an average, he must be prepared to care for 3,000 to 5,000 on special days. That is equal to an entire brigade of infantry. Herr TRAUTWEILER does not think so many people will patronize the line, but even his estimate of the number of passengers will make the question of providing sufficient room a serious one.

The blasting of the tunnels and rooms will require an enormous sum of money, and it is not likely that the majority of tourists can be made to consider the trip a safe one. There will be little comfort in such an excursion under any circumstances. Physicians, moreover, say that the journey is apt to cause some slight discomforts.

On the summit of the Jungfrau the barometer shows a pressure of three-fifths of an atmosphere on an average, and it may sink to one-half an atmosphere.

Although the majority of cases of mountain sickness are probably due as much to the exertion of the ascent as to change in pressure of the air, yet it is questionable if a rapid variation of the pressure on the lungs would not tend to increase any slight disease of those organs. Everyone who has made such ascents heretofore has had a strong constitution, and a diminution of half an atmosphere pressure caused but little trouble.

The Winter will have injurious effects on the works beyond doubt. Water will certainly enter the tunnels, freeze in Winter, and, in the Spring, in thawing out, will begin its work of destruction. The construction of the tunnels will be extremely expensive, yet it is technically possible beyond doubt.

The main objection is that the revenue will be out of all proportion to the capital invested, and that it will be difficult to raise sufficient sums to warrant the construction.

Herr TRAUTWEILER answers these objections thus:

There are certainly great difficulties to be overcome. The heights to be surmounted are very great, the transportation of the materials will be difficult, the workmen will require special attention although their number will not be very great. The tunnels will be started at from six to eight points, which will considerably decrease the time of construction. At each heading four drills will be used. The lower the heading, the greater the number of men that can be employed. From the third year of construction on, when the side tunnels are completed and the main tunnel only is under way, hardly more than 40 men can be employed, Materials can be transported by mules for part of the distance up the mountain; beyond this point everything will be handled by rope lines.

The stone of the mountain is limestone below and granite above. Both are of a firm quality.

Special difficulties to be surmounted by this railway are:

1. Snow and ice. People say that the line cannot be operated since the mountain is covered with snow and ice throughout the year. This will be of little account, however, since the road is subterranean.

2. The water that filters in will be very destructive. Herr TRAUTWEILER contends that the temperature will remain so nearly constant in the tunnel that little is to be feared from this source.

3. The cold in the tunnel will be excessive. The following statement is based upon well established facts. The mean temperature on the summit of the mountain is between 5° and 14° Fahr., at the foot it is 50° Fahr., and at a depth of 15 m. below the surface the mean temperature of the place is always to be found. The air in the tunnel will have the temperature of the tunnel walls beyond doubt, so we may count upon an average of 25° Fahr. in the whole tunnel. This is much better than the excessive heat under which the workmen on the Gotthard tunnel suffered.

4. The difference in pressure. It is said that a change of one-third of an atmosphere in the two hours taken by the trip, will cause slight illness or even fainting. This is contrary to experience. In pneumatic foundation work, the workmen pass from the outside air to the lower chambers, where a pressure of three or four atmospheres is maintained, without serious consequences, although the transition is made in about 40 minutes on an average.

5. The draught in the tunnel will be unbearable. This can be easily avoided by proper doors, as was done on the Gotthard tunnel.

6. The ventilation of the headings will be difficult. This is a statement of no weight. It is well known that a heading more than 100 m. long, must be artificially ventilated, and it is as easy to do this for an upright, as a horizontal shaft.

For every kilo of dynamite exploded, 100 cu. m. of air must be provided. Each meter length of the tunnel will require about 15 or 20 kilos. of dynamite, so 2,000 cu. m. of air will be demanded of the pumps, which must, therefore, be 40 or 50 H. P.

It will be seen that every one admits that the railway can be built; whether it should or not is another matter.

Herr BODER'S opinion is as follows:

"I consider that the railway can be built without great difficulty, for what is to prevent our driving four tunnels, the longest not more than two kilos in length? The ventilation will be very easily managed also.

"The length of the trip through each tunnel will be between 10 and 25 minutes, if the cars have a speed of about 150 m., as is usually the case. At each station the passengers will stop long enough to become accustomed to the rarer air.

"I consider that the Jungfrau railway is also financially practicable, in which connection I would call attention to the fact that the Trautweiler plan is the more economical. Moreover, in my opinion, the price of the tickets will have little influence on the number of passengers. The Jungfrau is excellently situated from a business point of view, since Interlaken, at its foot, is accessible from several sides, and is visited by nearly every traveler in Switzerland.

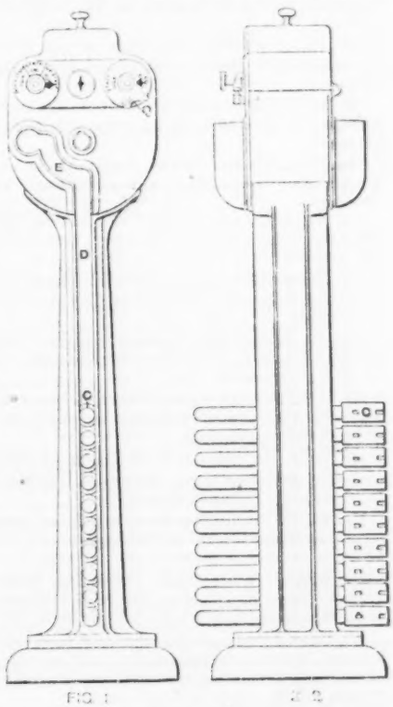
"What effect this has on the traffic I can easily show. Salzburg is a similar station in our Alps, although the number of tourists it receives is not so great as at the Swiss village. Everyone has seen the crowded cars ascending the Gaisberg each pleasant day, and I have repeatedly observed that there was little or no difference in the numbers carried, whether it rained or the sun shone. The tourists were 'doing' Salzburg. The Gaisberg was one of the sights, hence it must be seen, rain or shine."

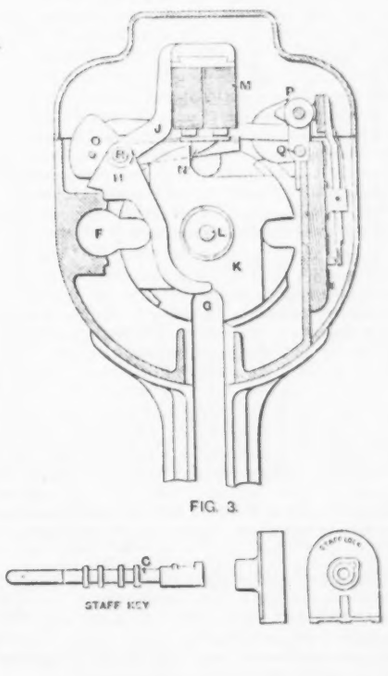
In the discussion that followed the address, it was stated that the Trautweiler plan would cost 5,750,000 fr. ($1,150,000), and require 5 years in execution. Herr TRAUTWEILER is a well-known Swiss engineer, who was actively employed in the construction of the St. Gotthard and Bruenig Railways.

The Swiss Bundesrath has under consideration two charters for a line up the Jungfrau and it is extremely probable that one will be granted. It is well known that there is a company formed ready to carry out any plan that is approved by competent engineers and railway operators.

The Webb and Thompson Staff Apparatus.

The English train staff system for the control of trains and the locking of sidings on single lines of railways is a system with which few of our American readers are familiar. The old "staff and ticket" system long in use, and still to a considerable extent in use, on English roads is rapidly growing obsolete on account of the delays and inconveniences resulting from its employment, and a "tablet" system has already in many cases supplanted it. The apparatus here illustrated is similar in principle, but is much improved and simplified and with special features added. As shown in the illustration, for which and the following description of its working we are indebted to *Industries*, the ordinary "train staff is still retained, as being familiar to railway officials. The apparatus illustrated is the joint production of Mr. F. W. WEBB and Mr. A. M. THOMPSON, both Members of the Institution of Civil Engineers, and it has been approved by the English Board of Trade, and adopted on the London and Northwestern Ry. It has worked on a busy section of the line for two years without failure in securing sidings connected with the main line.





The Webb and Thompson Train Staff Apparatus.

It would take too much space, says *Industries*, and demand too elaborate diagrams, to explain the action of the apparatus in all its minutiæ, but a general description may be of service. In the case of a single line between two points *A* and *B*, there can be no collision if there is one staff which has to be carried by any train passing between them. But if two trains want to go from *A* to *B*, and the first carries the staff to *B*, and leaves it there, the second train is delayed till another comes from *B* to *A* and brings the staff back. This apparatus supplies a number of staffs, but is so arranged that there can only be one staff out at a time. Figs. 1 and 2 show a pillar with 10 staffs. To remove a staff it is raised along the slot *D*, round the curved channel *E* to the enlargement, where it can be pulled out. In removing it it turns a set of disks, shown in Fig. 3, through a quarter of a circle; as it passes up the curved channel *E* it moves the notch *G* to the position opposite *F*. The disks are notched, as shown in Fig. 3. The disks are locked whenever a staff is removed. For instance, if all the staffs are in, and one is to be taken out, on raising it it is held by the disks, which are mechanically and electrically locked. The rings *C* on the staffs release the mechanical catches, but an electrical catch, *J*, *M*, *N*, has to be released. This is done by a circuit through the other station, a single line wire being employed for both the apparatus and bells. In returning a staff the disks are rotated back a quarter turn. As each set of disks has four notches it can be in four positions. Calling the position of the bottom notches (1) when no staff is out, the notches on the right side (2), the top notches (3), and the notches on the left side (4). Now, taking out a staff from *A* and putting it in at *B* moves the *A* disks to (2) and moves the *B* disks to (4), another journey moves them back to (1) if from *B* to *A*, or to (3) if from *A* to *B*. Thus, whenever a staff is out, the two sets of discs are one at an odd number and the other at an even number, but when the staff is put back they are both at an odd or at an even number. The electrical catch can only be liberated when the sets of disks are both at odd or at even numbers, so that more than one staff at a time can never be out. Then again the apparatus is so arranged that a staff may be withdrawn for shunting purposes, which admits of shunting being performed on the single line with absolute safety and the cost of providing covering signals avoided, the staff being replaced when the work is complete. Combined with these special advantages the apparatus admits of a single line being utilized to its fullest capacity, as a staff is always at hand when wanted; and the traffic is not disarranged by specials or trains running out of course, as they can be passed forward without a moment's delay as soon as a preceding train has cleared the section, and as each train carries a staff, and each staff is provided with a key, all siding points can be secured at a trifling cost, and the cost of providing signals avoided; and finally the ordinary block instruments may be dispensed with, the apparatus itself being the most perfect block instrument known.

New Signal Plant on the Central R. R. of New Jersey.

The Central R. R. of New Jersey is putting in a complete and automatic block signal plant between Jersey City and Bergen Point, and will have it in full operation in the course of a few weeks. This plant is on the electro-pneumatic system. Compressed air is supplied from a central station, and each semaphore arm is operated by a separate cylinder and gear fitted to the signal post. The valves of this operating apparatus are controlled by electricity. In a building near the Communipaw roundhouse are located two Norwalk air compressors, two Bab-

cock & Wilcox boilers and three tanks. From these tanks the air is carried in iron pipes, 2 ins. inside diameter, with screw joints, to a distance of 7¾ miles. Through yards, etc., the pipe is laid under the ballast between the tracks; in other parts of the line it is generally above ground, supported on short stakes at one side of the line. Expansion slip joints are put in at intervals of about 1,000 ft. The pressure in the pipe is about 60 lbs. per sq. in.

The track is divided into sections or blocks, which are insulated electrically by wooden splice bars at the rail joints at the end of the sections. A strip of non-conducting material is also placed between the ends of the rails. To insure a perfect continuity of the current along each section of track, the rails are connected at the joints by wire loops, with a stud at each end, which is tapped into the flange of the rail. On each section is a pit or cellar containing the batteries which furnish the current for that section.

This plant is worked in double or overlapping blocks. At the end of each block is a separate signal post for each track, and each post has two arms or blades. The upper arm (and lamp) is red, and the lower arm (and lamp) is green. The operation of the system is as follows, taking, for example, three blocks, *A-B*, *B-C*, and *C-D*, with a signal post or semaphore at *A*, *B*, *C*, and *D*. When a train enters the block *A-B* both arms on the post at *A* are automatically set at the horizontal or "danger" position. When the train passes *B* onto the block *B-C* it sets both blades on post *B* at "danger," and releases the red blade on post *A*. When it passes *C* onto the block *C-D* it sets both blades on post *C* at "danger," releases the red blade on post *B*, and also releases the green blade on post *A*. If the driver of a following train finds both blades on post *A* at "danger," he knows there is a train on block *A-B*, and must stop his train. To prevent undue delay by any accident to the apparatus the driver is only required to stop for two minutes; if at the end of that time the blades are still up he may proceed with caution, expecting to find the line blocked. If the red blade only is down it indicates "track clear" on block *A-B*, and "train on line" on block *B-C*. If both blades are down the driver knows he has "track clear" for blocks *A-B* and *B-C*. Should any obstruction be placed on the tracks, a switch be thrown so as to foul the main track, or should a rail break, the signals will be automatically set to indicate "danger." The same thing will occur in the event of a train parting and the rear section stopping on a block.

When a yard is located on a block, and it would be undesirable that switching operations would stop trains two blocks away, the yard is cut out from the main circuit, and is protected by a signal having its own special battery, and being properly connected with the switches from the main track.

Near Jersey City the blocks are quite short on account of the large number of trains to be handled, but farther out the length of the blocks is increased as the traffic diminishes. The traffic is very heavy. The winter schedule now in force shows 134 incoming and 135 outgoing trains per day. From 8.04 to 8.57 A. M., and from 9.03 to 9.59 A. M., there are respectively 13 and 16 incoming trains. From 4.05 to 4.57 P. M., and from 5.05 to 5.59 P. M., there are respectively 10 and 18 outgoing trains. During the summer season, the traffic is considerably heavier.

To increase the traffic facilities, extra tracks are being laid, so that there will be four tracks on the busiest parts of the line. On the main tracks 76-lb. rails are being laid to replace 70-lb. rails. The new terminal station was described in ENGINEERING NEWS Oct. 6, 1888.

The signal plant above described is one of the specialties of the Union Switch & Signal Co., of Pittsburg, Pa., and is being put in by that company. Mechanical signaling is in operation at several junctions and at the Jersey City terminus, where all the train and switching operations at the depot (12 tracks connecting with a 4-track road) and terminal yard are controlled from a large signal cabin having some 70 levers. Most of this plant has been put in by the Union Switch & Signal Co. The railway also has a plant put in by the Johnson Signal Co. and the National Signal Co.; the signals made by the latter company have a torpedo attachment operated in connection with the blade; the torpedoes project over the rail and will be exploded by the engine wheels should the driver run past the signal while it is at "danger." It is not the practice on this road to use compensators in the signal wires, it being thought better to adjust the wires by taking up or letting out links in the chain at the signal cabin, according to changes of temperature.

The various improvements are being carried out by Mr. J. H. OLHAUSEN, General Superintendent. Mr. FEIL is Supervisor of Signals.

PERSONALS.

Mr. OLIVER T. GIDDINGS, Architect, died at Exeter, N. H., March 15.

Mr. H. E. MCDONALD has been appointed city engineer at Belfast, Me.

MR. EDWARD DOLAN has been appointed Superintendent of Water-Works at Troy, N. Y.

Mr. J. H. SULLIVAN has been appointed Superintendent of Water-Works, at Sioux City, Ia.

Mr. SOL HAAS has been appointed General Traffic Manager of the Richmond & Danville system.

Mr. J. A. LARNARD has resigned the position of Superintendent of the Jacksonville, Tampa & Key West R. R.

MR. O. W. POTTER, Chairman of the Executive Committee of the Illinois Steel Co., of Chicago, has resigned.

Mr. JOHN S. FARLOW, President of the Cincinnati, Sandusky & Cleveland R. R., died at Newton, Mass., March 24.

MR. CHARLES H. HEWES, Assistant Naval Contractor, Navy Department, died at Norfolk, Va., on March 18.

Mr. JOHN B. CARSON, Vice-President and General Manager of the Louisville, New Albany & Chicago R. R., has resigned.

Mr. ELLIOTT HOLBROOK, General Superintendent and Chief Engineer of the Pittsburg & Lake Erie R. R., has resigned.

MR. W. J. MURPHY, General Superintendent of the "Erie" division of the New York, Lake Erie & Western R. R., has resigned.

Mr. E. B. THOMAS is said to have declined to accept the position of Vice-President of the New York, New Haven & Hartford R. R. Co.

Mr. H. J. MILLER has been appointed Superintendent of the Jeffersonville, Madison & Indianapolis R. R., vice Mr. W. F. BLACK, resigned.

Mr. W. P. THORP has been appointed Superintendent of Water-Works, at Cincinnati, O. Mr. FRANK BURNS is Assistant Superintendent.

Mr. WM. H. WEIGHTMAN, Consulting Engineer, expert in patent causes and machine design, has removed to the Para Building, 35 Warren St., New York City.

Mr. FRANK CHRYSLER has entered into partnership with Mr. ANDREW ROSEWATER, under the firm name of Rosewater & Chrysler, civil and sanitary engineers, Omaha, Neb.

Mr. E. A. CANNON, Assistant U. S. Engineer, in charge of the Elk River division of the Muscle Shoals Improvement, Tennessee River, has resigned, and will return to Minneapolis, Minn.

Mr. WM. GOLDEN, railway contractor, who carried out the repairs of the West Point Tunnel after it caved in, was run over and killed on the West Shore R. R., at Newburg, N. Y., March 16.

Mr. LEONARD EVERETT, an engineer and dredging contractor, died at Lockport, N. Y., recently. At the time of his death he was General Superintendent of the American District Steam Co.

Mr. C. M. CRAIG, M. Am. Soc. C. E., has been appointed Chief Engineer of the Alabama Midland R. R. and the Montgomery, Tuscaloosa & Memphis R. R., vice Mr. H. A. SCHWANECKE, resigned.

Mr. W. E. COSTELLO has been appointed Superintendent of the Kansas City Division of the Atchison, Topeka & Santa Fe R. R., with headquarters at Fort Madison, vice C. L. NICHOLS, resigned.

MR. JONATHAN Y. SCAMMON died recently at Chicago, Ill. In company with Mr. WM. B. OGDEN he took up the completion of the Chicago & Galena Union Ry., which had been started in 1836 and abandoned in 1837.

Mr. OSCAR SANNE has opened an office as Consulting Engineer at the Colby & Abbott Building, Milwaukee, Wis., and has been appointed Consulting Engineer for the La Crosse (Wis.) highway bridge over the Mississippi River.

Mr. WILLIAM KENT, M. Am. Soc. M. E., has opened an office as Consulting Engineer in the *Times* Building, New York City. His specialties are in machinery, machine designs, tests of materials, etc. He is also the New York representative of the Pittsburg Testing Laboratory.

Capt. F. A. MAHAN, U. S. Corps of Engineers, has been transferred as Engineer to the Fourth Lighthouse Department, relieving Major CHARLES W. RAYMOND. His headquarters will be in Philadelphia. Major AMOS STICKNEY, U. S. Engineer Corps, will succeed Capt. MAHAN, at Buffalo, N. Y.

Mr. G. H. NICKERSON, has been appointed Division Engineer, Supervisor of Bridges and Buildings, and General Roadmaster of the Utah Division, Union Pacific Ry., with office at Salt Lake City, vice Mr. A. F. DOREMUS, resigned. Mr. C. T. RESSEGUIE is General Manager and Mr. W. W. RITER, Superintendent.

Mr. JOHN I. BANKS has been appointed Superintendent of Bridges, Buildings and Water Supply of the Chicago, St. Paul & Kansas City Ry. Co., with headquarters at Dubuque, Ia., vice Mr. C. H. EGGERS, resigned. Mr. H. FERNSTROM is Chief Engineer, and Mr. C. SHIELDS, General Superintendent, with offices at St. Paul, Minn.

Major H. WADSWORTH CLARKE, M. Am. Soc. C. E., has been appointed City Engineer of Syracuse, N. Y. He was appointed City Surveyor in 1864, but resigned to enter the army. After the war he was appointed City Engineer, and held the position for several years. He was engineer for the Onondaga Creek commission; had charge of the resurvey of the boundary line between New York and Pennsylvania, under the joint boundary commission, from 1877 to 1885; also upon the boundary line between New Jersey and New York in 1882.

Mr. CHARLES L. COLBY, of Milwaukee, Wis., has resigned the presidency of the Wisconsin Central Co., and Wisconsin Central R. R. Co. Mr. E. H. ABBOTT was elected President and Treasurer of both corporations, and Mr. HOWARD MORRIS, Assistant Secretary, was elected Secretary of the corporations, a position made vacant by the election of Mr. ABBOTT to the presidency. Mr. HENRY F. SPENCER, of Boston, was chosen Assistant Secretary and also Director, in place of Mr. COLGATE HOYT, of New York, who resigned from the Directory. It is reported that Mr. COLBY may be chosen President of the Northern Pacific R. R. Co.

MR. JOHN C. CAMPBELL, formerly Chief Engineer of the Public Works Department of New York City, died in this city March 26. He was born in Cherry Valley, Otsego Co., in 1817. His first work of importance was on the Croton Reservoir under Mr. JERVIS. Later he built a portion of the Hudson River Railroad through the Highlands. In 1859 he went to Panama as Chief Engineer of the western portion of the Panama R. R. His health failing, he was obliged to return home, and soon after constructed a road in Indiana, and subsequently was General Superintendent of a road in Wisconsin. On returning to his native State he was appointed to a position on the Croton Reservoir, and became Engineer in Chief of the Public Works, a position which he held for many years. He was one of the most prominent engineers in the United States, and devoted his time principally to water-works. His word was authority on all matters of hydraulic engineering. Latterly he had been interested in some important works in California.

PUBLICATIONS RECEIVED.

—*Report of the Board of Sewer Commissioners*, 1889. Brockville, Ont. With the report of the engineer, Mr Willis Chipman.

—*Proceedings of the Department of Superintendence of the National Educational Association at its Meeting in Washington, March 6-8, 1889.* Pamphlet, 5¾ × 9 ins. 300 pp. Washington, 1889.

—*City of Newton (Mass.) Report of the Water Board for the Year ending Dec. 31, 1889.* Pamphlet, 70 pp. H. NELSON HYDE, Jr., Superintendent.

In addition to the usual matter, the report of A. FTELEY and City Engineer ALBERT F. NOYES, on a high-service supply, is included.

—*The History of Federal and State Aid to Higher Education in the United States.* By FRANK W. BLACKMAR, Ph. D. Pamphlet. 5¾ × 9 ins. 343 pp. Washington, 1890.

This is No. 9 of the series known as "Contributions to American Educational History," edited by Prof. H. B. ADAMS, and issued by the Bureau of Education.

—*Annual Report of the Water Commissioners of the Town of Plymouth (Mass.), for 1889.* Pamphlet, 26 pp. R. W. BAGNELL, Superintendent.

In common with the New Bedford and Newton reports noted above, this report gives a summary of statistics in accordance with the suggestions of the New England Water-Works Association.

—*Twentieth Annual Report of the New Bedford Water Board.* Dec. 25, 1889. Pamphlet, 77 pp. R. C. P. COGGESHALL, Superintendent.

This report contains a water analysis by the State Board of Health; a "diagram showing the consumption, height of water and rainfall at the storing reservoir from the commencement," or for the past 20 years, the showing being by months; also a table showing the rainfall at New Bedford for the past 76 years, from the records of THOS. R. RODMAN.

—*Charts of the U. S. Coast and Geodetic Survey.*—T. C. MENDENHALL, Superintendent, Washington, D. C.
Annual Change of the Magnetic Declination for the Epoch January, 1890. Scale 1: 10,000,000.
Magnetic Meridians of the United States for January, 1890. Scale 1: 10,000,000.
Isogonic Chart for the Epoch 1890. Alaska and Adjacent Regions. Scale 1: 13,700,000.
Isogonic Chart of the United States for the Epoch 1890. Scale 1: 7,000,000.

—*Annual Reports, Corporation of the City of Victoria (B. C.) for the Year ending Dec.* 31, 1889. Pamphlet, 91 pp. JNO. GRANT, Mayor. PETER SUMMERFIELD, Water Commissioner.

These reports cover the various departments of the city. The water commissioners report contains a table showing the location of each hydrant; its elevation above high water mark; the size of the main upon which it is located; the initial pressure, or pressure on hydrant with only ordinary consumption, averaging about 50,000 imp. galls. per hour; the remaining pressure, or pressure upon hydrant when in addition to above consumption a 2½ in. fire hose stream was being thrown from the hydrant through a 1-in. nozzle; and lastly the distance said stream was thrown.

—*Coast Survey Bulletins*, Nos. 14, 15, 16, 17.

No. 14. *Approximate Times of Combinations and Elongations and of the Azimuths at Elongation of Polaris*, 1889 to 1910. Prepared by CHAS. A. SCHOTT, Asst.

This will be a very useful bulletin to engineers and surveyors.

No. 15. *Verification of Weights and Measures.*

We made a note as to this useful bulletin, giving details as to standard base at Washington, some weeks ago.

No. 16. *Description of two new Transit Instruments for Longitude Work.* With cuts and full description.

No. 17. *Relation between the Metric Length Standards of the U. S. C. S. and U. S. Lake Survey.* A fine example of the details of micrometric work in the comparison of standard measures.

All the above bulletins consist of but a few pages each, and can be obtained on application to Prof. T. C. MENDENHALL, Supt. U. S. C. S.

TRADE PUBLICATIONS.

—*Locomotives.*—Illustrated list of tank locomotives for branch lines, collieries, contractors' work, etc. Pamphlet, 28 pp. Peckett & Sons, Bristol, England.

These are four and six coupled tank engines, generally with saddle tanks. We note with interest that most of them have outside cylinders.

—*Locomotives.*—Folding card of small photographs of a number of engines of different classes, for English and foreign lines. Several of these engines have outside cylinders and 4-wheel trucks. Tank engines are in the majority, that being a type of engine much used by English engineers both at home and abroad.

—*Railway Equipment.*—Pocket manual, 4¼ × 2¾ ins., 12 pp. American Supply Co., Kansas City, Mo.

This little manual contains tables of tons of rails per mile; number of bolts, spikes and track equipment, street rails, etc.

Steam Heating for Railway Cars.—Illustrated description of the system of the Erie Car Heating Co., of Erie, Pa. Size, 12⅛ x 9¼, 20 pp.

The steam is taken from the dome of the engine through a reducing valve. At each end of the car, under the platform, is a coil, from which pipes run down each side of the aisle, with radiating pipes under the seats. The coupling is made by plungers and stuffing boxes, making a slip joint. This system has been tried on the Pennsylvania R. R. (Fort Wayne division); New York, Chicago & St. Louis R. R., and Lake Shore & Michigan Southern Ry.

SOCIETY PROCEEDINGS.

Engineers' Club of Cincinnati.—At the February meeting of the club 26 members were present.

A budget of short papers by various members was read, the subjects chosen being as follows:

1. Some Curiosities of our State Boundaries.
2. Turn-Outs.
3. Phonography as an Aid to Engineers.
4. Elevation of Outer Rail on Curved Trestles.
5. A Method of Pile Driving Under Special Conditions.
6. A Plea for a Natural Motor.

Boston Society of Civil Engineers.—The annual meeting was held March 19, President FitzGerald in the chair, 45 members and 40 visitors present. The following persons were elected members of the society: David A. Harrington, John L. Howard, Clarence A. Perkins and Frank H. Snow. The Secretary read the annual reports of the government and of the Treasurer. The annual reports of the several special committees of the society were received and their consideration assigned to the next meeting, the government in the meantime to print and distribute such of them as seemed advisable.

The following officers were elected: President, Clemens Herschel; Vice-President (for two years), John R. Freeman; Secretary, S. Everett Tinkham; Treasurer, Henry Manley; Librarian, Frank W. Hodgdon; Director (for two years), Frederick Brooks.

Mr. Cope Whitehouse, of New York, addressed the society on "The Raijan Canal and Irrigation in the Nile Valley." The address was illustrated by lantern slides. At the conclusion of the address Mr. Whitehouse showed a number of views of the Pyramids of Egypt, and explained his theory in regard to their construction.

The Western Railway Club.—The regular monthly meeting of the Western Railway Club in Chicago, on March 18, 1890, with Vice-President Barr in the chair.

Mr. Peck, chairman of the committee on joint inspection of cars in Chicago, presented the following report:

REPORT OF COMMITTEE ON JOINT CARD.

Your committee, appointed at a special meeting, held at the rooms of the Western Railway Club, Jan. 21, 1890, to recommend a joint card and a set of rules to govern the use of such card, in order to facilitate the prompt handling of loaded and empty cars between the lines centering in Chicago, beg to submit the following:

1. The roads subscribing agree to the use of a "Chicago joint defect card," which may be applied by the receiving road for such old defects or mixed material that do not render the car unsafe to run or unsafe to trainmen.

2. The joint card shall be 3½ x 8 in., yellow in color, with black letters, printed on both sides, and of the following form:

CHICAGO JOINT CARD.

(Name of Road.) Received.....Car No.....

From..... Date.....189...

With following defects:.....

.....

Fill in old defects or mixed material on both sides with ink or indelible pencil.

Attach this card securely to the intermediate sill between the two cross-tie timbers.

Chicago Inspector.

3. The "joint defect card" is to be used only in cases where the delivering company's inspector is located so far from the receiving road that it is impracticable to procure a regular M. C. B. card, or when the defects are of the nature explained in Rule 1.

4. The card is to be filled out on both sides, with ink or indelible pencil, and to be attached securely to the intermediate sill between the two cross tie timbers, and shall be removed by the company delivering the car when the car is returned.

5. It is distinctly understood that this "joint card" is not in any way intended to conflict with the regular M. C. B. card. The railroad company issuing the card may be called upon to pay bills should any non-subscriber to these rules render them.

6. These rules shall be binding, on each subscriber, for six months from March 1; at the end of that time any railroad company may withdraw from the agreement by giving 30 days' notice of such withdrawal.

7. Any railroad company may become a party to these rules by notifying the secretary of the Western Railway Club.

PETER H. PECK, C. & W. I. Ry.,
R. D. SMITH, C., B. & Q. Ry.,
R. WHARTON, C. & N. W. Ry.,
Committee.

This card caused considerable discussion, and the further consideration of it was postponed to the next meeting. The committee on publication of proceedings made an amended report, abolishing the selling to technical papers of transcripts of the stenographer's notes, and sending a proof to any member requesting to revise his personal remarks. The secretary is to publish the proceedings on the Monday following the meeting, and send them free to members, and to others for $1 per year.

Mr. G. W. RHODES then offered suggestions on a proposed change in interchange rules. As this is treated as a change in the existing rules, by the addition and alteration of paragraphs, it is not suitable for publication here. The discussion which followed turned on the "defect cards." Mr. A. M. Waitt thought that while wheels worn out in fair usage are to be replaced by the owners, there seemed no good reason why the same rule should not apply to journal bearings and, possibly, brake-shoes. Mr. Rhodes thought the difficulty would come in determining when the journals were "worn out." There is no way of tracing them, like wheels and axles. Mr. Rhodes introduced a new rule, No. 16, as follows:

Rule 16. In repairing damaged cars, M. C. B. standards may be used, when of design and dimensions that do not mar or impair the strength of the car, in lieu of the parts forming its original construction.

The M. C. B. automatic drawbar of any recognized manufacture may be used, providing it conforms strictly to the lines adopted by the association, and also providing that not less than 25,000 cars are in successful service equipped with the drawbar.

Engineers' Club of St Louis.—Meeting March 19, 1890. President Nipher in the chair; 40 members and 5 visitors present.

Prof. J. H. Johnson read an address on the Organization of a Federal Council of Engineers. This address treated of the present status of engineers as compared with the members of other professions, and indicated some of the advantages that might result from a national organization. He gave an abstract of the qualifications required for membership in most of the engineering societies in the country, together with the number of full grade members, showing a total of over 5,000. The author mentioned, as among the functions of a general organization, the establishment of a uniform grade of qualifications for admission; some attention to the education of engineers, and the class and rank of the degrees given by engineering schools; the proper use of the title "engineer"; some attention to the ethics of the profession; the formation of a general library; the establishment of permanent headquarters for engineers; the joint publication of proceedings and papers, as well as an index of general engineering literature; the awarding of medals for papers of value, and for engineering work of exceptional merit; the advocacy of State control over engineering structures; engineering representation on certain State boards, and in the direction of municipal works; the securing of government aid in making tests of material; the establishing of standards of tests and shapes, and forms for making reports; the appointment of committees to investigate failures of engineering structures, as well as to report upon the success of new methods and structures; the entertainment of distinguished visitors, etc. The author believed that an organization of this kind would unify the interests of engineers and mark a new era in the profession. In the discussion Mr. Seddon states that his own view of the situation was that this club was doing well as now situated, and while it should not be too conservative, it would do well to go slow in the matter, holding itself in readiness to take advantage of any general movement that might develop.

Col. Meier called attention to the different movements in this direction that had already been made, and thought that that of the American Society of Civil Engineers promised best results.

Mr. Robt. Moore desired to know by what authority board of managers of the association had appointed this committee. He thought that some of the objections raised to a general organization were still unanswered, and he was not sure that the wider objects aimed at could be attained; or, if attained, would be found of much real value. He saw a decided difference between the profession of engineering and those of medicine and law where general organizations served specific purposes. He called particular attention to the fact that engineering in these days is not a single profession but a dozen. The committee of conference, it should be remembered, was not official or representative, either as to the association or to the various clubs.

Prof. Johnson, in reply, stated that the present action was not being taken by these committees as representing the sentiment of the engineering bodies of which they were members, but unofficially, simply with a view of mutual conference, with the possibility of developing some plan for future action, which might in due time be submitted for the consideration of the societies.

Mr. McMath thought that such a council as proposed by Prof. Johnson would not be representative, but in time would be made up of aristocrats. He thought that if a general organization were ever reached, it must come in one of two ways: First, as a purely representative body; second, by absorption. In his opinion, the latter plan promised the best results. He was not sure that it was desirable that all who called themselves engineers should unite. The interests to be considered were very diverse, and he thought it best to go slow. Prof. Potter thought that this question was one of development, which in time would work out its own solution. Mr. Wheeler called attention to the experience of one of the national bodies, where the diversity of interests had led to the division of the society into eight or ten sections, each with its special work. These sections had found more to interest them in their special work than in the general organization, and some of them were withdrawing from the national body, and there was great danger of disintegration. This experience might be worth considering now. He thought that the establishing of standards and the entertainment of visitors were points upon which the societies should co-operate, but that in his opinion the formation of one general association would result in such an incongruous mass that its efficiency and stability would be doubtful. Mr. Beahan considered this question one of growth and education. He did not see the necessity of a "trade mark" for engineers, neither did he see that it could do any harm. Prof. Johnson stated that while it was true that there were many different branches of engineering, he still thought there were numerous questions of general interest which would furnish work for a national organization. He called attention to the fact that the general public did not, as yet, recognize engineering as a profession. Mr. Taussig stated that this was in a large measure due to the fact that engineers themselves did not insist on such recognition. In his opinion, this could be overcome by a combined effort of engineers individually. WM. H. BRYAN, Secretary.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

Published Weekly at Tribune Building, New York.

Vol. XXIII. Saturday, March 29, 1890.

D. McN. STAUFFER A. M. WELLINGTON
EDITORS.
CHAS. W. BAKER E. E. R. TRATMAN M. N. BAKER
ASSOCIATE EDITORS.
GEO. H. FROST.....BUSINESS MANAGER

SUBSCRIPTIONS.

To United States, Canada, and Mexico.

One Year, **$5.00;** *6 months,* **$2.50;** *3 months,* **$1.50;** *Single Copies, 12 cents. To all* **Foreign Countries** *of the Postal Union, add $2.08 to above prices for postage.*

CLUB RATES.

Two new subscriptions	$9.00
One renewal and one new subscription	9.00
Five new subscriptions	20.00
One renewal and four new subscriptions	20.00

Subscribers *can have the mailing address of their paper changed as often as they desire. Send both the old and the new addresses.*

The date *when the subscription expires is on the address label on each paper, the change of which to a subsequent date becomes a receipt for remittance.* **No other receipt** *is sent unless requested.*

Advertising rates, 20 cents per line *agate measure. Schedule sent on request.* **Changes** *of advertisements must be in hand on Tuesday afternoon; New advertisements Wednesday afternoon;* **Transient** *advertisements not later than Thursday noon. The last pages go to press early on Friday, and we will be obliged if parties who fail to receive their papers promptly will notify us without delay.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty, or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

COMING TECHNICAL MEETINGS.

Western Society of Engineers, Chicago, Ill.—Next meeting, April 2. Secy., J. W. Weston, 230 La Salle St.

Engineers' Club of St. Louis, Mo.—Next meeting, April 2. "The Smoke Problem." Wm. B. Potter. Secy., W. H. Bryan, 309 So. 7th St.

American Society of Civil Engineers, New York.—Next meeting, April 2. Secy., John Bogart, 127 E. 23d St.

Civil Engineering Society (Mass. Inst. of Technology), Boston, Mass.—Next meeting, April 3. Secy., Clement March.

Engineers' Club of Philadelphia, Pa.—Next meeting, April 5. Secy., Howard Murphy, 1122 Girard St.

Engineers' Club of Kansas City, Mo.—Next meeting, April 7. "Bridge Foundations in the Kansas River," E. I. Varnsworth. Secy., Kenneth Allen, 200 Baird Building.

Civil Engineers' Society, St. Paul, Minn.—Next meeting, April 7. Secy., Geo. L. Wilson, City Hall.

Civil Engineers' Club, Cleveland, O.—Next meeting, April 8. Secy., C. O. Palmer, 22 Cedar Ave.

Civil Engineers' Association of Kansas, Wichita, Kan.—Next meeting, April 9. Secy., J. C. Herring, Wichita.

New England Railway Club, Boston Mass.—Next meeting, April 9. Secy., F. M. Curtis, Old Colony R. R. Rooms in the United States Hotel.

Engineering Association of the Southwest, Nashville, Tenn.—Next meeting, April 10. Secy., Olin H. Landreth, Vanderbilt University.

Western Railway Club, Chicago, Ill.—Next meeting, April 15. Rooms in the Phœnix Building. Secy., W. D. Crosman.

Engineers' Society of Western Pennsylvania.—Next meeting, April 15. Secy., S. M. Wickersham, Pittsburg, Pa.

Boston Society of Civil Engineers.—Next meeting, April 16. Secy., S. E. Tinkham, City Hall.

New York Railway Club.—Next meeting, April 17. Rooms, at 118 Liberty St.

American Water-Works Association.—Annual meeting at Chicago, Ill., May 20. Secy., J. M. Diven, Elmira, N. Y.

Master Car-Builders' Association.—Annual convention at Hygeia Hotel, Fortress Monroe, Va., June 10. Sec., J. W. Cloud, Buffalo, N. Y.

American Railway Master Mechanics' Association.—Annual convention in June. Sec., Angus Sinclair, 140 Nassau St., New York.

IN noting a somewhat complicated crossing plan in our issue of March 15, we inadvertently gave credit for the entire plant to the Johnston Railroad Frog & Switch Co. The fact is that eight of the crossing frogs were constructed by the Frog, Switch and Signal Department of the Pennsylvania Steel Co. The mistake was made by our correspondent in gathering the information in Philadelphia, and we make this correction in justice to both of the well-known firms interested.

THE New York State Board of Railroad Commissioners have rendered a decision on the Lake Shore disaster near Hamburg, N. Y., censuring in severe terms the conductor and engine driver, and in regard to the Cowell coupler making the following short and pithy finding:

The Board has made careful examination of the Cowell coupler, which gave way first at Dunkirk and then at Hamburg. The Board deems that such couplers are in the highest degree dangerous, and should not be used.

The substance of the view expressed therein is precisely our own, and has been from the first, it seeming to us for several reasons highly reprehensible that at this late day there should be such a mixture of couplers in extensive use on the road, neither of them being of the best type known, and one of them being a mere experiment which careful and disinterested observers have long seen, was foredoomed to failure. But though we ordinarily have the courage of our convictions, perhaps too much so, we confess that we shrank in this case from saying anything on a question so mingled with private interests, albeit one which seemed to especially demand plain-spoken comment.

AT the end of a truly thrilling description which appears in the Denver *Republican* of the plucky and hazardous voyage down the Grand Cañon of the Colorado, Chief Engineer STANTON makes the following remarks on the question of the suitability of the Cañon for a railway line:

Perhaps some one will say just here: "You have not told us of the railroad. Can it be built?" It is true; in so many words I have not answered that question. And you must excuse me, at this time, from going into that part of the subject.

But go with me for a moment back over the picture, and then answer the question for yourselves.

A great river flowing in long, sweeping stretches—whose grade through this portion is less than 8 ft per mile (not a little mountain stream as steep as Clear Creek); granite walls it is true—but walls that slope in general at an angle approaching 40° from vertical, miles upon miles of easy hill-sides and grass covered slopes—20 to 25 miles of close cañon, and then a marble bench just the right height, just the right grade, and wide enough for four tracks, and I return the question to you: Can a railroad be built through the Grand Cañon as far as Diamond Creek?

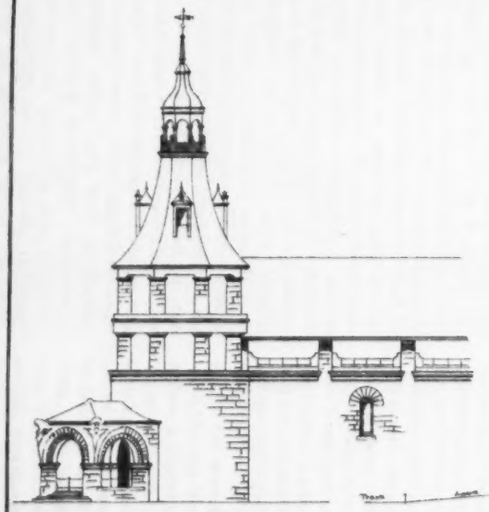
The 53 miles of cañon below Diamond Creek we have not seen; of this we cannot speak. It will be but a few days till its angles will be measured by our transit, and sun pictures of its walls, its flats and its valleys will be stolen by our camera, and taken home as incontestible evidence of what it contains.

If this description be fairly correct it answers the question, and that it is fairly correct is intrinsically probable. The line will naturally be a costly one. Where there is so much rock there must naturally be heavy expense; but the very immensity of the gorge is a safeguard in many ways against excessive work. To mention only one item, beyond those we have previously spoken of: The thousands of side cañons which doubtless existed when the main cañon began to form have long since cut backward and upward until many united into one, so that in the deeper part of the main cañon there naturally would not be, as Mr. STANTON says there are not, a tenth or a hundreth as many cross-gorges to pass as there would be, or would have been, higher up. And owing to the fact that the bottom of the main cañon is largely cut through solid rock, it is natural that at a level just above high water the mouths of these lateral gorges should also be narrow, as is said to be the fact, although expanding, higher up, to a great width. While the line cannot prove a cheap one, the work is of a nature to be done very cheaply per cubic yard; and what between the advantages of the line as a freight route, its attractiveness as a passenger route, and the practical certainty that valuable mineral deposits are made accessible by such a tremendous vertical cut through the earth's strata, we should expect it to prove no more costly in proportion to merit than any other route to the Pacific.

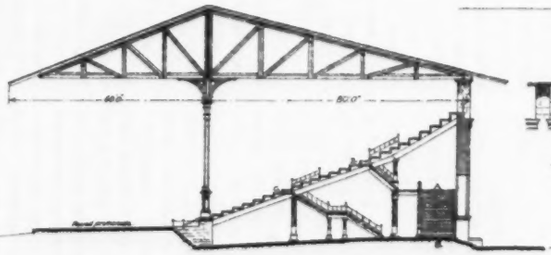
THE County Council of London is very anxious to secure the New River water-works by purchase, and they ask Parliament to permit them to expend $25,000 in promoting public inquiry into the existing methods and rates of the private company, and in discussing ways and means of acquiring control on the part of the metropolis. Meanwhile the New River Company quietly goes on with ever increasing revenue from rates and real estate, and there is no statutory limit to their dividends. The London *Engineer* says that the true revenue from the large and important estates of the company, including 50 acres in the heart of London, is not a matter of official record, and cannot be ascertained with any certainty. But the dividend paid is now more than 12 per cent on the nominal value of the shares, and the dividend on one undivided share has increased from $6,700, in 1868, to $13,050 in 1888. That some of this increase in value comes from water supplied is shown by the fact that between 1880 and 1888 the New River rate has increased from $187.92 to $200.94 per million gallons. This rate would have still further advanced had it not been for the Water Rate Definition Act of 1885, which declared "annual value" to be "rateable value." The *Engineer* wisely suggests that if London is to buy out the eight metropolitan water companies, it is evident that delay will only enhance the ultimate cost to the metropolis. London is rapidly extending its bounds and adding thereby to the revenues of the water companies—the total increment in the last eight years being figured at $1,440,000 for all the companies. This must be paid for, however ingeniously the terms may be arranged, says our contemporary.

THERE is more merit in the suggestion contained in the letter of Mr. JULIUS W. ADAMS, in this issue than may at first appear to the casual reader. Mr. ADAMS proposes that Watling Island be made the scene of certain preliminary ceremonies on Oct. 14, 1892, and that the opening of the World's Fair proper be postponed until it can be done with credit to the nation. To be honest about it, there is a good bit of empty sentiment connected with the anniversary of a date upon which COLUMBUS landed on a small island 400 miles distant from the nearest point on our coast. We have been celebrating "centennials" since 1876, and are used to them; and now that the stock is exhausted we naturally turn to a quadricentennial as the next best available excuse.

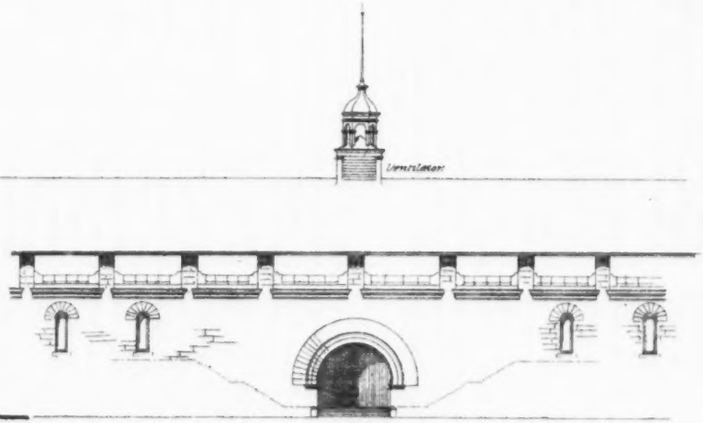
But, after all, the real motive in holding such an exhibition is not to honor a man who never saw our territory in his venturesome sea-voyage of four centuries ago, but to show to the nations of to-day what progress we have made as Americans since the exhibition of 1876. The date of opening selected is a sentiment, a pretext; the holding of the Fair is a commercial and economical reality that does not depend upon Columbus or any day of any year for its success. The plan proposed by Mr. ADAMS has the advantage of honoring the sentiment in a way that will be eminently useful to the nation, and yet leave the greater Fair to be opened in a manner that shall do the United States honor and credit. France does not, as a rule, await anniversaries or centennials for the opening of her exhibitions, and the exhibition of last year would probably have been a woful fail-



End Tower and Entrance.



Cross Section.



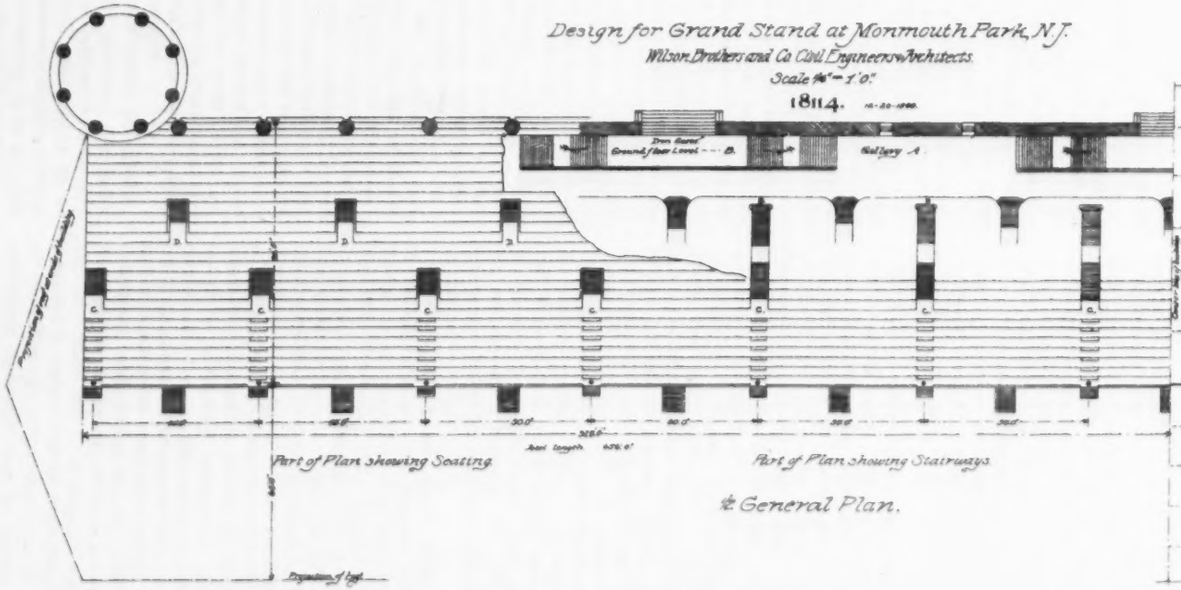
One of Three Main Entrances.

Design for Grand Stand at Monmouth Park, N.J.

Wilson Brothers and Co. Civil Engineers & Architects.

Scale 1/8" = 1'0".

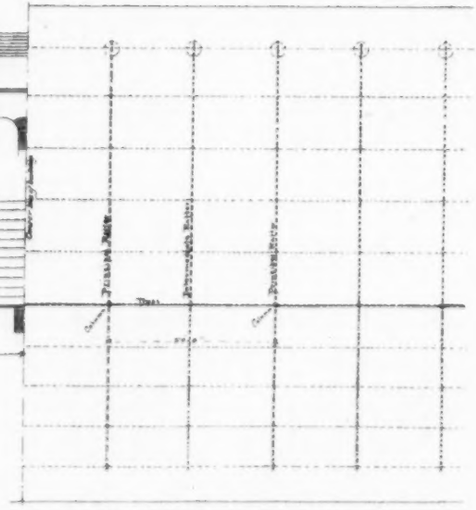
1814. 10-20-1900.



Part of Plan showing Seating.

Part of Plan showing Stairways.

The General Plan.



Part of Roof showing Framing.

CHAS. HART & SONS, LITH., 26 VESEY ST., N.Y.

ure if the fact that it was the centennial of republican rule in France and marked the downfall of kings, had not aroused so much opposition among the other and non-democratic nations of Europe, that unusual efforts were put forth to make it a success.

We expect profit as a nation from the holding of our Fair, and it would be absurd and foolish to allow a Columbian sentiment to possibly turn what should be what we *can* make it, into an abortive fizzle, in buildings, exhibits and results. We honestly believe that what is wanted cannot be secured in the two short years between now and 1892, and hence we heartily agree with the postponement of the date of opening, and commend as worthy of the fullest attention the compromise suggested by Col. ADAMS.

REAR-ADMIRAL RICHARD C. MAYNE, C. B., M. P., has lately recommended in a lecture before the Royal United Service Institution the abolition of the naval engineer as a separate class of officers aboard English war ships. The admiral has persuaded himself that the line officers can "soon" be taught a sufficient amount of engineering lore to supervise and direct the engine-room artificers, "by whom the principal part of this engineering work is now performed," and he is further convinced that the line officer would bring to the discharge of his duties, "superior habits of command, etc." For this suggested radical "reform," and for an expression of opinion which is worthy of the days of wooden hulls and sailing ships, London *Engineering* takes the gallant admiral severely to task, and gives him some advice that would not be lost on some of the less progressive officers of our own navy. As we hinted last week, there is in both the English and American navies, and especially among many of the younger officers, an underlying conviction that the work of an engineer officer aboard ship is altogether of an inferior class to that performed by the line; and that the knowledge required in and about the engine-room is something that "any fellow" can pick up by a few months' hard work.

While some are very slow to realize the changes that have taken place in naval warfare in the last 30 years, it is no less true that the engineer is the master in modern war-ships, and without his aid the "fighting officer" would be literally helpless. Sails are obsolete in battle and, except as economizers of fuel in cruising ships, or as a remnant of motive power in case of an emergency, might be dispensed with altogether. But a battle ship of to-day, in the ship itself, in its engines, its guns and its manœuvres, is the creature and the servant of the engineer; and that this servant may be made to obey the will of its master, that master must have a range of knowledge and experience undreamed of by the bravest of those officers who made glorious the old navies of England and America. To commence with, the line officer must now be himself an engineer to a very considerable extent before he can understand his ship, work his torpedoes and handle his machine guns, or fully appreciate the mechanical efficiency of that wonderful machine, a modern battle-ship. But he might just as well take upon himself the duties of the surgeon or the simpler work of the paymaster and the chaplain, as to assume, with Admiral MAYNE, that he was, or could soon be made, competent to intelligently and properly direct the thousand details connected with the machinery of the ship. The line officers of to-day must be men highly trained in many branches besides the "command" of men; and their success as fighting men depends, to a great extent, upon their knowledge of the machines which have now supplanted manual labor. If he is thoroughly competent to command his crew, to handle his ship, guns, torpedos and explosives, and to perform the many other duties of the executive officer, his hands are full. He has no time to devote either to the acquirement of the necessary knowledge or the performance of the other equally important duties relating to the propulsion of his ship, pumping, draining, flooding and ventilating arrangements, and the maintenance of his hull and machinery of many kinds. The demand of the day is for two distinct classes of officers, both equally well trained in their separate professions, and both vitally essential to naval success. The line officer must necessarily command the ship and all the officers in it: but it should not take another generation to teach Admiral MAYNE and men of his class and way of thinking that the position of the naval engineer is one requiring an equal if not superior range of knowledge and training to their own, and that it is altogether an honorable one.

The Chicago Exposition Building.

If there is to be a World's Fair at Chicago in 1893, and it begins to be pretty certain that there will be, we all desire that it should be a success, by attracting both exhibits and visitors from all over the world; and experience seems to clearly indicate that this success will depend far more on having some one conspicuous feature of commanding interest than on having a multitude of minor exhibits, however meritorious and interesting in themselves. The result of the first and last of these great exhibitions, the most successful ones of the whole series, is alone almost a proof of this; and the great attraction of both of these was the novelty and beauty of the buildings. The success of the first London Exhibition lay in the great Crystal Palace, then a most striking novelty. The success of the last Paris Exhibition lay even more conspicuously in the great Eiffel Tower, worthily seconded by the grand Machinery Hall.

But as the Crystal Palace idea has undoubtedly lost its attractiveness from many repetitions, and in fact was never strong after the first exhibition, so we believe any mere repetition of the Eiffel Tower idea will prove equally ineffectual, especially if all that is copied from it is its altitude, without its symmetry and grace, as seems to be the inane intent of most of its American would-be imitators.

It is obvious that the most natural way of obtaining such a feature for any exposition is in the character of the buildings, rather than in any single exhibit or collection of exhibits, however important. For these reasons we have from the first maintained that a mere multiplication of one-story sheds, to cover however large an area, would be a great mistake; and a mere copy of the Eiffel tower—especially if it merely copied its height without its grace—would be a still greater mistake, however much higher it might be run. Either, in our belief, would be not only an inartistic crime, but a commercial blunder. The plan which we earnestly favored at New York, as our readers will remember, was the suggestion of Messrs. ADAMS, MCALPINE and WORTHEN for a great permanent exposition building of iron and glass, on Governor's Island, in stories, including, say, 100 acres of floor space in a 20-acre building. This, we still hold, would have been the best plan for New York, providing at once a great ornament to the harbor, a needed summer garden and concert hall for the people, a hall for great gatherings, and an opportunity for recurring expositions every decade or so at small expense, as well as providing for the immediate necessity.

For Chicago this plan would be far less suitable; in fact, is almost out of the question. The building could not be made permanent without prohibitory expense for land which could ill be spared, and if made permanent, there would not be nearly so much need or use for it as at New York. The question therefore is a most urgent one: What can be done at Chicago to give the needed combination of novelty, grandeur and beauty to the exposition buildings, and so insure success?

No suggestion to this end has seemed to us so happy as that recently made by Mr. E. S. JENISON, architect, of Chicago, described in outline in our issue of March 15, and in somewhat fuller detail in a letter from Mr. JENISON which appears in another column. As to the details of the plan proposed, and especially as to the details of the estimate, we have as yet no opinion to express, either *pro* or *con*, but in conception the plan appears to us on further reflection as of even greater merit than it did when we prepared our first description; so much so, that we apprehend that the Exposition authorities could not do better than to accept the outlines of the plan as a finality and contract the realm of doubt to the particular size and location of the building, in which there is undeniably still legitimate room for doubt.

Mr. JENISON'S plan in outline is a vast metallic tent, with a central tent pole serving as a tower, and also supporting a single roof over the whole area carried on cables which likewise serve to stay the top of the tower, so that it may be a true pole, having only stiffness enough not to spring, and only strength enough to resist a vertical load, not lateral forces.

It needs but a moment's thought to see that, granted that some high tower is necessary as an attraction to visitors, this is a most economical plan. The tower is greatly reduced in cost by being stayed at the top by the roof cables; the roof is also enormously reduced in cost by having the tower to support its centre at a great altitude, so that it may be carried entirely by cables in tension, the most economical possible use of material. This form of structure also tends strongly to grandeur of interior effect by covering a vast area by a roof at great height, without any obstruction by supporting columns.

So far there will be little dispute as to the merits of Mr. JENISON'S idea. When it comes to precise proportions and details, difference of opinion will and ought to exist, and a wide leeway of choice is permissible without serious sacrifice of the main features of the scheme. The project as announced is for a central tower 1,100 ft. high, supporting a roof over a building 3,000 ft. in diameter, or covering 162½ acres. The area of the roof itself is still larger, 184½ acres, owing to its being on a slant, and not horizontal. This building, it is claimed by the estimate in another column, can be built for $6,000,000, or only $37,000 per acre, as against about $75,000 per acre for the main buildings at Paris and Philadelphia, and $42,500 per acre for the London Crystal Palace. Experience at the 1867 Exposition in Paris clearly showed that no better ground plan than a circle could be devised for an exposition building, the nations being arranged on radial lines, and the classes of exhibits on concentric circles.

But should such an area as 173 acres be roofed in it would be far larger than has ever before been roofed for any exposition, the usual area having been 60 to 80 acres, all told. The New York Site Committee only proposed 65 acres of main buildings under roof, which would be afforded by a circular building 1,900 ft. in diameter. Similarly, it is not at all necessary to have the central tower so high as 1,100 ft. It may be well to do so for the moral effect, if otherwise convenient, but at Chicago it will be particularly senseless to make great height a *sine qua non*, there being absolutely nothing to see except a semicircle of lake on the east and of prairie on the west, with a cloud of smoke underneath enshrouding the city, however high the tower be carried up. With a tower 1,100 ft. high the horizon will be 44 miles off, while with a tower 800 ft. high it will be 37½ miles off; that is all the difference, while the view of the city underneath (granting that the smoke nuisance is abolished, which is hardly to be hoped for) would rather lose than gain in distinctness from the greater altitude.

It is therefore not at all necessary to adopt Mr. JENISON'S gigantic proportions to fully carry out

his conception. The area and cost may be cut down one-half and still leave it the largest and highest and, it may fairly be claimed, most original building erected by man. And here comes in the advantage of adopting a plan like this, which will excite world-wide interest from its novelty, apart from mere size or beauty of detail. A tower which is merely a tower must out-Eiffel EIFFEL to have any drawing power at all, and even then, as we have stated, would probably fail of its purpose. Any tower so far proposed at least would be quite certain to excite ridicule from its ugliness, and ridicule is fatal to drawing power. But when the tall tower becomes an integral part of a great structure, there will be something new and striking to see from the top of it in the mere roof itself. It will not be necessary to "go one better" than Mr. EIFFEL to have the tower, roof and building together one of the greatest attractions; possibly by far the greatest which any great exposition has yet enjoyed.

This is particularly so because of a possibility as to which we are in a position to speak with some authority, although it has probably not yet even occurred to Mr. JENISON, or to any of those directly interested in the Exposition, as even remotely possible. We have direct information, which we believe to be entirely trustworthy, that the art of producing aluminum in large quantities, at low cost, has already advanced so far that it will be not only possible but easy to roof the entire structure with pure aluminum plates at a total cost but little more than the galvanized iron roof which would otherwise be used, deducting the value of old material; that is to say, the total cost of putting on and removing the aluminum, added to interest on its value as old metal, and including the saving in strains, from the less weight of the aluminum (which would be an important element in a roof of such span), and from the diminished glass area necessary to fully light the interior, would but little exceed the cost of a galvanized iron roof for material and labor together, all of which would be worth little or would be, practically, a dead loss.

Such a roof over such a building would be positively startling in its novelty; a world-wide attraction to educated and ignorant alike. To the eye it would appear to be of burnished silver, inside and out, but with the advantage over silver that it would not lose its polish, however long exposed, even in the defiled atmosphere which we fear will surround it. It would have the incidental advantage over iron of reducing to a minimum the transmission of heat to the interior, the sky-light space needed in the roof, and the amount of electric light needed by night. The effect either by day or by night, and either within or without, would certainly be most novel and brilliant; but the most useful effect of such a roof, justifying a very considerable expense to attain it, would be the service to which we have alluded, as *the feature* of the Exposition; an exhibit on a grand scale of the sudden growth of a new art among us, one till lately hardly dreamt of and of American origin, which is now advancing with great rapidity into an important interest, but which must wait until 1892 in any case before its real importance is fully appreciated by the general public.

There is, of course, nothing of high art in a project of this kind, with or without the aluminum roof; but this seems to us rather fortunate than otherwise. High art is rather a hazardous thing to attempt in this country on a great scale and in a great hurry; and we could at best hardly hope to outdo Paris, with a strong probability that we should fall far below her. There is nothing offensive to good taste in the project, but quite the contrary. It is strictly in accordance with the Eastlake motto: "Ornament your construction, but do not construct your ornament," the construction being on so vast a scale as to need no ornament but simplicity. All the architects of genius did not die with RICHARDSON, and we might be fortunate enough to have buildings of the Paris type fall into the hands of two or three of them; but we also might not, and the chances are we should not. It is therefore in every way desirable that we should not attempt to compete with them directly.

The practical and engineering arts are rather our strong points, and a building worthily illustrating these arts is perhaps the more appropriate for any world's fair, and certainly for one in America, only three years ahead. That a building of the type suggested by Mr. JENISON would worthily do this, and lead the whole world to wish to see it, we fully believe. Without some such feature to excite interest and stimulate the zeal of exhibitors, there is at least a possibility that the Chicago Exposition will sink into something little more attractive than a gigantic country fair, disappointing in its exhibits, and still more so in its buildings and general effect.

In this we have said nothing of engineering details, nor do we now intend to do so; first, because we are not prepared to discuss them, and secondly, because even the attempt to do so would be premature. This we may say, that we do not yet understand how Mr. JENISON proposes to construct his tower of railroad iron, nor do we believe that he has allowed nearly enough for the cost of his foundations. This, however, may be said; that except for the wind and temperature strains, the construction of the building would be a simple matter. The wind strains are a most serious element, which will have to be carefully studied. Ideas as to the proper provisions to be made for them will differ widely. There should be no skimping in so doing, since the building may be exposed to a tornado, and it would be a most unhappy and disgraceful end to the exposition to have it blow over. On the other hand, there are certain compensating advantages. The form of the roof will tend to decrease wind pressure more than we were at first disposed to believe, and over so large an area a much less allowance per square foot may properly be made than for a smaller structure. If the roof be anchored down by tension cables so that it cannot rise on the leeward side, it obviously cannot sink in to any considerable extent on the windward side, and this anchorage it is proposed to provide from the tower and not from the ground. The motion at the top of the tower on a windy day might be so great as to make it highly unpleasant for visitors; but this would in no way imply real weakness, even if the tower had to be closed on such days. The inertia of so many thousand tons of material in the roof would greatly tend to reduce vibration. For the same reason, frequent interior stays would not be necessary to insure adequate stability of the roof. Although the building would be nothing more in reality than a gigantic tent, analogy with the flapping tent roofs of common experience should not lead us to fear the same phenomenon in the larger structure. The weight of such a roof would be so great that no upward bellying from internal air pressure need be feared in any case. Other difficulties in plenty, needing careful study, will occur to any engineer, but if there be any which the resources of engineering will not easily provide for, they have not occurred to us. We earnestly commend the project to the consideration of the profession and of the people of Chicago.

Notes by Rail.

[EDITORIAL CORRESPONDENCE.]

THINGS AND PEOPLE IN PHILADELPHIA.

In not one of the works that I visited in Philadelphia did I hear the complaint of "hard times." In at least two-thirds of the establishments the report was, "More orders coming in than we can fill;" or, "We have enough orders to keep us busy for months." And at almost every place in that city some improvements or extensions contemplated or under way were pointed out to me. In many cases, of course, nothing more than refitting with some new machinery is proposed, but there are quite a number of cases where new buildings are being added.

I described last week the new machine shop of the Southwark Foundry & Machine Co., and the large new building to be added to the machine tool works of Bement, Miles & Co. was noticed some months ago in the ENGINEERING NEWS. At the office of the J. G. Brill Co., street car builders, I found a still more radical move in progress. The old shops in West Philadelphia are wholly inadequate to handle the amount of orders received, and their extension is not feasible. The firm has, therefore, purchased a tract of 18 acres at Mt. Moriah, about 4 miles out of Philadelphia, lying between the Philadelphia, Wilmington & Baltimore and the Baltimore & Ohio railways, and is putting up there an extensive plant, consisting of blacksmith shop, machine shop, erecting shop, paint shop, wood shop, iron storehouse, boiler house, engine house and lumber sheds. As land is not so expensive there as in the city, the buildings will be one-story structures, with monitor roofs, walls of brick, and wood floors laid on 10-in. hemlock girders. The roofs are to be covered with Warren Ehret's "slag" roofing, a tar composition. All the shops will be warmed with steam pipes, set low. In the present works it was attempted to heat with overhead piping, but the system did not work successfully. One reason may have been that there was little or no high-speed machinery to keep the air circulating.

In the shop I saw some elegant cars just ready for shipment for an electric railway at Nashville, Tenn.; also some 8-wheeled cars for a Chicago cable railway, and some passenger and freight cars for Nicaragua. One little novelty on one of these cars was a self-opening platform gate, invented by Mr. BRILL. It is merely a gate of the "jointed ×" type, attached to the car at one side, and at the other side having a round rod of ⅛ in. diameter attached. When the latch of the gate is opened, the weight of this rod shuts the gate together, and swings it to one side out of the way.

The new shops at Mt. Moriah will probably be in full operation by August. At least 500 men will be employed at the start, and it is the intention to increase this largely. A little town is already springing up about the new works. Many old employés have moved their families to the new location, and are securing houses there much more roomy and comfortable than they could afford in the city.

While I was in West Philadelphia I went to see the new library building at the University of Pennsylvania, which will be finished before the next Commencement. The building is built largely of very red terra-cotta, and the contrast between this color and the green stone of the other buildings is hardly pleasant. Taken by itself, however, it is a building of which the University and its alumni can well be proud. The interior arrangement seems very good. Great pains have been taken to make the building fireproof. The only combustible material in the book room will be the books themselves and the shelves, which are of oak. The shelf supports are of rolled steel, with perforations to receive iron hooks, on which the shelves rest.

I have been curious to know whether the electric motor is proving nowadays a serious competitor of the gas engine. Of course the former is suited to many uses to which the latter is not applicable, but for the uses of small manufacturers and the like the two machines come into sharp competition. At the Otto Gas Engine works, of Messrs. Schleicher, Schumm & Co., in West Philadelphia, I had an interesting conversation with a member of the firm on this and kindred topics. It seems that electric motors have been very "popular." Of course many users of power are ignorant of the elementary principles of physics, and have an idea that an electric motor has a mysterious ability to create something out of nothing. The first cost of an electric motor is small, too, of course, compared with a gas engine, and this has been, and is, a great point to gain it popularity. The recent fatalities with electric wires in which the general public has taken such an interest, have made people rather afraid of electricity, however, and gas engine makers have recovered some of their former customers.

Of course this is merely the way the non-technical public look on the matter. From the engineer's standpoint it is well understood that, other things being equal, the electric motor can beat any rival in the small powers, and the steam engine is without a competitor for large powers. Between these two extremes comes the gas engine, which, requiring little care compared with the steam engine, and no storage of fuel or ashes, has become very popular for small powers up to 10 H. P.

It has gained this popularity, however, on account of its convenience and automatic operation, and not on account of its economy, since in most cases it has used ordinary illuminating gas, costing $1 to $3 per thousand cu. ft. But by the use of cheap "producer gas," made from anthracite pea coal, the gas engine shows a great advantage over the steam engine in point of fuel economy. Its theoretical advantages have long been understood, and Otto engines are now working with a consumption of less than 1¼ lbs. coal per H. P. hour in daily practice.

Gas engines have received comparatively little attention from American engineers because of the high price of gas and the low price of coal. European engineers have given the matter much more attention and have secured excellent results.

RAILWAY MATTERS.

I called on one of the Philadelphia & Reading officers, the day after the fast run was made from Philadelphia to New York (noted two weeks ago in ENGINEERING NEWS), and found him in very good humor over the feat. It is curious, by the way, how much interest the general public takes in a performance of this sort. I overheard a discussion upon it while in a Harrisburg street car ten days afterward. "Well," concluded one of the speakers, "there's no reason why the Reading shouldn't make good time there. They've got a straight track and a level one, with just enough Jersey sand on the rail to give the drivers a grip."

There is no doubt that the Reading can make remarkably fast time between Philadelphia and New York, whenever it will pay to do it. That will be when it has a convenient and central terminus at Philadelphia, into which it can run trains with as little delay as the Pennsylvania has in entering Broad St. station. An officer of the Reading, who is in a position to speak authoritatively, told me that when the company was able to run trains over an elevated road to Twelfth and Market, regular trains would be put on, making the run from Philadelphia to New York in 90 minutes. With this, too, will come changes in the connecting tracks between the Reading and the Baltimore & Ohio, which will make through fast runs between New York and Washington also a regular thing. Track tanks for the fast trains are now being put on the Delaware River bridge, the idea being that speed has to be slackened anyway at this point. It will be interesting to note whether placing the trough at this point will cause the ties and floor timbers to decay more rapidly. It seems likely that this may be the case, but if care is taken to replace them before they get weak, the extra cost will not be much, and the saving in time is, of course, important.

That portion of Philadelphia in the vicinity of the Baldwin Locomotive Works has come to be quite largely devoted to railway manufactures. One of these establishments, nearly as old as the Baldwin Works, is the car wheel foundry of A. Whitney & Sons. I was much interested in the tests and improvements which were shown me, evidencing the care which is being taken in this work. The contracting chill invented by Mr. Whitney is used almost entirely in the works, about $20,000 having been expended in making the change from the ordinary chills. There is a general impression, I find, that the contracting chill wheel has fins of considerable size on its tread, which, according to the theories of some alarmists, are likely to cause serious injury to the rail. In some cases this may have been so, but it is not the case with the Whitney contracting chill, as the treads of wheels cast in it are practically as smooth as those cast in the common chills. The claims for the contracting chill are of two classes—first, that it is cheaper for the wheel maker, since less bad wheels occur with it than with the ordinary chill; second, that the wheels so cast are more perfect in size and shape, have a harder tread and a deeper and more uniform chill, and, to my mind most important of all—a softer and tougher iron can be used and a chill of sufficient depth secured, thus making a wheel which will stand more hard service over battered stub switches and antediluvian frogs than a wheel with more brittle metal.

The works are just finishing an order of 10,000 wheels for the Savannah, Florida & Western Ry. Out of the first 9,000 inspected by the R. W. Hunt Bureau 89.6 per cent. have not varied ⅛ in. in circumference. No trouble whatever is now experienced with the wheel being "out of round," although formerly it was a serious annoyance. One good thing about the contracting chill is that it is a very durable improvement. Out of 600 chills in use for 3 years only 12 have been thrown out for any cause whatever, and only two of these were broken.

When one of the members of the firm was abroad some years ago he made an attempt to introduce American chilled wheels in England. The government regulations stood in the way of their use on railway cars, but it was thought that it might be possible to bring them into use for the wheels of mine cars, where steel-tired wheels were and are in use. The engineers, however, pooh-poohed at the notion that it would be safe to use a cast-iron wheel under a mine car, and were strongly inclined to regard Mr. Whitney as a Yankee spinner of yarns when he said that all sorts of cars and engines were run in the United States on cast-iron wheels. The wheels they were using cost them £50 per ton. He offered to deliver them wheels of cast iron at £15 per ton, and endeavored to get them at least to try some cast-iron wheels. But they were not to be seduced into the adoption of any such new idea, and the firm has had enough to do of late to supply its American customers without trying to work up a foreign trade.

Just across the street from the Baldwin Works are the shops of the United States Metallic Packing Co. Ever since the days when a hemp string was first jammed into a stuffing box, inventors have been at work on the problem of a metallic packing, and so many have failed that engineers generally lost confidence in the idea. I am of the opinion that the success of the United States metallic packing is due as much, or more, to the care which has been taken to insure mechanical accuracy in the fitting and finishing of the device as to the invention itself.

It is now in use on between 3,000 and 4,000 locomotives on the Pennsylvania system, and is ordered to be applied to all stuffing boxes except the one on the throttle-valve rod, on all new engines and old engines going through the shop. Other prominent roads using it are the Baltimore & Ohio and Canadian Pacific. I noticed that a very considerable proportion of the orders in the shop were from abroad, as for example, Spain, Bombay, and Bradford, Eng. This packing has also found much favor in marine engine work. All the latest transatlantic greyhounds are equipped with it.

The babbit metal lining for the packing rings is composed of 100 parts tin, 9 parts copper, and 6 parts antimony. In preparing it great care is necessary not to burn the tin. The copper and antimony are melted together and the tin is melted separately. When melted, the metal in the two pots is poured slowly together into a third pot and stirred with a stick of green wood during the pouring. This gives a babbit metal of exceptionally fine grain and even composition.

In the grinding room I saw a good illustration of the fact that the simplest method is after all the best. Two spherical surfaces have to be ground together, so a machine is rigged with vertical spindles having two bearings which are set slightly out of line. Of course the spindle wabbles as it revolves, and the bearing loosely mounted on the lower end of the spindle is tipped this way and that and revolved at the same time, so that it is ground to a fit with no hand work.

VARIOUS NOTES.

I propounded the conundrum to a prominent manufacturer of cast-iron pipe as to why such a large proportion of the factories are located in New Jersey, and was informed that it was because sand was so plentiful there, and also by reason of the facilities for shipment by water on the Delaware river. It is a little singular, nevertheless, that these advantages should offset the disadvantages of having to bring the coal and iron from distant points. The iron pipe trade is not very active, however, just now. There are a great number of new water-works projected, as the columns of ENGINEERING NEWS show, but the percentage which have advanced far enough to order material is comparatively small. A good deal is being done, however, upon extensions of old works.

If I remember rightly, in the report made several years ago by three distinguished engineers on improved pavements for Philadelphia, the system of paving by asphalt blocks was commented on unfavorably on account of its tendency to wear unevenly. I have often noticed on Spring Garden St., in Philadelphia, a small area of this pavement whose condition confirmed the unfavorable opinion of the above report. At the company's office, however, I was told that this pavement was laid some years ago, when the process was a new one and the product was not uniform. Later improvements have obviated these defects and the pavement is now claimed to be as durable as sheet asphalt, with the advantage over that material that it costs less to to lay, is less slippery and so can be used on steeper grades, and is more easily cut through and replaced. Among cities where considerable amounts of this pavement are in use are Altoona, Camden and Trenton. I have since then noticed some of this paving at Altoona, and it seems to be wearing exceedingly well. I think no one will dispute that the pavement is the handsomest of any in use. In pavements, however, as the old proverb has it, handsome is as handsome does. If the durability of this pavement is assured, it is deserving of more extended use.

The paving subject reminds me that Philadelphians are thoroughly conversant with the art of laying abominable brick sidewalks. Of course everybody has heard of the little gutters across the sidewalk which carry the house drainage out to the street, and which a Philadelphian has learned to step over automatically when promenading; but I now refer to the state of affairs beneath these sidewalks. The ground beneath is plentifully supplied with water by virtue of the daily scrubbing which the walk receives, and when the frost comes out of this wet ground in the spring you feel the pavement sink with you at every step, while little mud geysers squirt up between the bricks in the most complacent way.

However, the things Philadelphia needs in an engineering way are such an old story that every one is tired of it. About the only point in which she can boast over her sister cities is in the fact that she owns her gas plant, and operates it herself. There is doubtless a good deal of politics in the management of the gas department, and perhaps new improvements are not adopted as rapidly as in works under private management; but on the whole the city gets its gas supply cheaper than any other large city in the country and has never been afflicted with the woe of having rival corporations tearing up its streets to parallel each others' lines of mains.

[TO BE CONTINUED.]

CORRESPONDENCE.

Bouscaren's Specifications—Correction.

CINCINNATI, March 24, 1890.

EDITOR ENGINEERING NEWS:

SIR: My attention has been called to a typographical error in my last specifications for railway bridges.

Page 4, paragraph 66, the formula $\frac{9{,}000}{1+\frac{d^2}{6{,}000\,\ell}}$

should be $\frac{9{,}000}{1+\frac{d^2}{6{,}000\,\ell^2}}$.

Yours truly, G. BOUSCAREN.

The Horizontal Stadia Rod.

ITHACA, N. Y., Feb. 18, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: In your last two numbers I have noticed communications concerning horizontal stadia rods, and from my point of view they have overlooked a very important objection to this method.

In the first place this new rod would have to be held in *some* position in the vertical plane through the transit and the foot of the rod, just the same as with the old rod; and, in addition, it must be held so that the line of the horizontal arms is perpendicular to the line of collimation of the transit, instead of being held exactly vertical as is the case with the old rod.

Now it is much easier for a common rodman to hold a rod plumb than to hold it so that these horizontal arms will be perpendicular to the line of collimation of the transit, and unless the latter position is exactly obtained an error will be produced just the same as if the old stadia rod were inclined.

I would suggest as a remedy for this that a pair of sights be fastened to the rod so that their line of sight is perpendicular to the horizontal arms, and thus the rodman could easily adjust his rod to its proper position.

Yours, F. K. WING.

Revolution Indicating.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: The following home-made method of determining the number of engine revolutions per minute may interest some of your readers who have steam yachts or small engines, when the revolutions do not exceed 400 per minute.

Hold a pencil firmly in a vertical position and keep the eye on a reciprocating part of the engine, catch the time from the engine by dotting with the pencil close to the edge of a piece of ruled paper. As your minute begins transfer the dotting to the paper and by slight motion prevent the dots from obliterating each other. The minute up, the dots may be counted, the ruling assisting in this.

The fact that the hand, the eye and the ear are working together a slip in the time keeping is noticed at once; so I am inclined to believe it gives a very accurate result

Yours, etc. G. E. R.

[This method will take some pretty lively counting when the speed approaches the limit indicated. But we believe it can be done by an expert with sufficient accuracy for the purpose intended. Some one of the several "revolution counters" in the market would be more certain, however.—ED. ENG. NEWS.]

Aluminum Transits.

CHICAGO, March 18, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: The writer has felt much interest in the suggestion made by the ENGINEERING NEWS as to the use of aluminum for engineering instruments. For *underground* use they are unsurpassed, and the ease with which one can climb ladders and clamber over old stopes is appreciated by those owning them. In this connection it seems but just to place credit for their first use with the engineers who ordered them, and the inclosed letter from Mr. LOWE puts the date at about 1878, although I think Major BRUNE's instrument was made even prior to that time. Very respectfully, N. L. PATTERSON.

[In the letter of Mr. THEO. H. LOWE, C. E., of Denver, Colo., inclosed, the writer said he had a Burt solar compass made about 1880 by Messrs. Young & Son, of Philadelphia. But Mr. LOWE thinks that Mr. F. F. BRUNE, C. E., of Leadville, Colo., had a solar compass manufactured from the same metal three years previous to 1880. The writer says that the only objection to the metal is that it is too soft for rough usage, and, "I think rather light in weight for field-work, as it is disturbed by the wind." But he says it is a great improvement in point of comfort over the 40-lb. transit for work where the wind disturbance is not a factor; his solar compass, with telescope counterpoise, gradienter and tripod, only weighs 15½ lbs.—ED. ENG. NEWS.]

Vertical Curves.

KANSAS CITY, Mo., March 18, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: Your warning as to the use of the rule given by Mr. E. ZAYAS in his letter on "Mexican Practice in Vertical Curves," published in the NEWS of 15th inst., is timely. The rule was given with other instructions to assistant engineers in charge of the details of the construction of a division of road where the maximum rate of grade was 1 per cent.

The line had been carefully located, and the grades so adjusted that breaks were in every case less than 1¼ per cent., and except at a few points they were less than 1 per cent.

The uniform length of vertical curve was 200 meters, or about 658 ft. The object in using a single length for such curves was to simplify the routine work of the engineer as far as it could be done without materially affecting the results.

As Mr. ZAYAS is not accustomed to foot measurement, he may be excused for a slight error in adapting the rule to a 500 ft. curve; it should be something as follows: Call the divergence of the grade lines or the algebraic difference of the two rates of grade in a distance of 250 ft. (one half the length of the curve A—instead of per 100 ft. as stated—*e. g.*, to connect $a + 0.5$ and -0.5 grade, we have $A = 1.0 \times 2.50 = 2.5$ ft. Then for the offsets to grade from the centre each way, we have for successive intervals of 50 ft.:

0.625 ft.	0.40 ft.	0.225 ft.	0.10 ft.	Point.
$0.25A$	$0.16A$	$0.09A$	$0.04A$.	Tangent.

H. H. FILLEY.

[With the above proviso, the rule is a good one, for the reason that its effect is not to shorten the curve with large intersections, but to lengthen it with small intersections, the changes being too small to do much harm, although the curve is rather longer than need be in some cases.—ED. ENG. NEWS.]

The Skew Portal Problem.

DENVER, Colo., Feb. 4, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: Having had occasion to solve the skew portal problem, we were surprised to find that, although using a different method of solution, our expressions were the same as those obtained by Mr. M. J. PATTERSON in your issue of April 15, 1889. Our method of solution is so different from his that you may think it of enough interest to publish the following demonstration:

We have used the same lettering, but it will be noticed that all our angles are the complements of those used and obtained by Mr. PATTERSON. We are inclined to think that our angles are a little handier than his. Instead of the skew angle we use the angle (with a slight correction hereafter noticed) formed by the intersection of the centre line of the bridge with the line connecting the centres of the end post footings.

As designated in the accompanying cut, let:

S = (90° skew angle).

E = Angle of end post with horizontal plane.

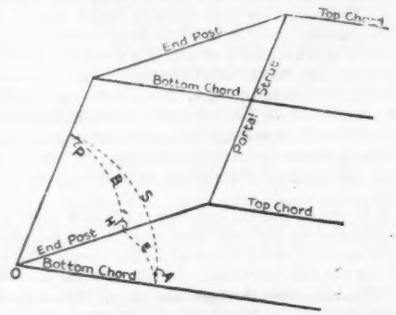
B = Bracket angle.

H = Angle between plane of portal and plane of truss.

P = Angle between plane of portal and horizontal plane.

A = 90° = Angle between horizontal plane and plane of truss.

Then if we measure off equal distances along the lines $O\,A$, $O\,H$, and $O\,P$, and connect the points A and H, H and P, and P and A by arcs in the planes formed by the



The Skew Portal Problem.

three lines, using O as a centre, the figure $A\,H\,P$ will be a right spherical triangle (right angle at A), the solution of which will give all the angles required for laying out the portal.

By spherical trigonometry:

$$\text{Cot } H = \text{Cot } S \text{ Sin. } E.$$
$$\text{Cos } B = \text{Cos } S \text{ Cos. } E.$$
$$\text{Cot } P = \text{Cot } E \text{ Sin. } S.$$

By remembering that our angles are the complements of Mr. PATTERSON's, it will be seen that our expressions are exactly the same as his.

If for any reason the trusses were inclined from the vertical plane, then the only difference would be that we would have to solve an oblique instead of a right spherical triangle.

A slight correction should be made to the angle S on account of the ends of the portal being away from the centre lines of the trusses by an amount equal to half the width of the end posts on each end.

Let S' = true angle to be used.

S = angle of centre lines.

f = ½ width, c. to c., of trusses.

g = ½ width of each end post.

then $\text{Cot } S' = \dfrac{f \text{ Cot } S}{f - g}$

F. A. STEIGER.

The Jenison Design for the Chicago Exposition Building.

CHICAGO, Ill., March 19, 1890.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: We desire to acknowledge the flattering mention of our proposed Exposition Building in your issue of March 15, and thank you for it. We recognized the necessity that you so readily discern of getting the backing of engineers, and it was for this purpose that we threw out our proposed plan so early.

But on the other side we think that we know designers well enough to know that they never accept "the other fellow's" methods as correct, if there is another method; and this idea has so strong a hold on us that we decided that we would in all human probability never have a chance to make the details of construction, even if the plan were adopted, as each construction company has its own engineer, its own peculiar beliefs and forms of material. But for the last nine months this matter has been under consideration, and many methods of construction have been analyzed and the resultant strains in each case so carefully figured as to enable us to feel safe to say that the design is a feasible one and can be built for less than $6,000,000. So we thought it best to throw out the scheme for the consideration of engineers, hoping that they would offer suggestions, even going so far as to think that it might be the means of enabling us to find the man who was really the most capable of taking charge of the work. For though our Mr. JENISON is a graduate civil engineer of the University of Michigan, he has no disposition to depend on his unaided figures and judgment in so important a problem, and we should at once call to our assistance the very best aid that could be engaged if the plan were adopted.

Our expectation is proving to be correct, as we are already getting criticisms *pro* and *con*. We send you this day prints of what we are at the present time most inclined to think favorably of as the proper method of construction. Though we do not care to tie ourselves to any one of the many fine sites at the disposal of the Committee, we have made our drawings and estimates for what we call our "Outer Harbor" site, where the water is now from 8 to 20 ft. deep, closed in from the lake by a government pier. There is a sandy bottom, and an underlying material of quicksand, clay, etc., to 80 ft., where we strike rock.

You raise the question that many others have raised about anchorage of the wall ends. There is the equivalent of 282,000 No. 7 wires on the outer wall. On top of this wall we would build an iron ring, anchored down to the bottom of the wall. Our idea is that the cables should be continued around the outside and staked down with piles. We add bill of quantities that will enable you to verify the cost if you will.

The things that we claim for the plan are:

1. That it is the largest building that ever was.
2. That it is the highest building that ever was.
3. That it is the cheapest building that ever was.
4. That it lends itself to the classification of exhibits, putting subjects on the peripheries, nations on the radial lines.
5. That it lends itself to the many wants of an exposition, including under its roof all the different interests of inventors, merchants, seamen, sportsmen, etc., ad libitum.
6. Each person that comes to see it will go away with a fixed impression of the whole, for he will have seen it all.
7. Being entirely made of merchantable material, it can be built promptly and will return $1,000,000 for uninjured material.

We inclose photo-gravure of perspective of interior. The general design has been under consideration for the last nine months, and our Mr. JENISON visited all the various exposition buildings of the world during the past fall, to gather additional facts.

E. S. JENISON & Co., Architects.

[The estimate inclosed, which we have not attempted as yet to check over in any way, is subjoined. The views and plans referred to we shall publish later, believing as we do that this plan is in its conception the best yet suggested. Some of the items of the estimate will doubtless seem small to others, as to us; but for reasons which we have discussed in another column, neither the precise size of the building nor of the estimates for it should be a determining factor in accepting or rejecting the plan.—ED. ENG. NEWS.]

Bill of Quantities.	Price.	Amount.
12,264 tons rails	$40.00	$490,560
566,739 lbs. bolts	10	56,673
1,495,680 lbs. rings	04	59,824
87,331 lbs. fish-plates and bolts	04	34,932
519,300 lbs. castings in foundation	03	15,579
Excavating inside of pole		10,000
Galleries on pole		100,000
Upper observatory		15,000
Lower observatory		40,000
Pole above observatory		25,000
Stair or bridges to lower gallery		5,000
46,601,859 lbs. wire	04	1,624,074
40,000 lbs. staples	10	4,000
972,816 ft. purlins	60.00	58,329
53,571 squares corrugated iron	6.00	321,426
26,785 squares skylight	20.00	535,700
23,540 sq. yds. canvas	35	8,239
204,295 lbs. rail on top of wall	40.00	4,080
16,714,512 brick	12.50	208,925
Plastering 6,880 yds	20	13,760
6,984 squares iron ceiling under second gallery	10.30	72,000
72,417,695 ft floor, joist and girders	20.00	1,448,340
113,472 ft. gallery posts	22.00	24,948
Amphitheatre extra		15,000
Gallery front extra		15,000
Windows and doors in outer wall		80,000
Stairs		15,000
Rails		20,000
Painting and glazing (not including roof)		30,000
Plumbing and gas fitting		3,000
Dirt on roadbed		40,000
I-beams at base of wall		2,160
60,000 piles	10.00	600,000
Total		$6,023,545

The Proposed Quadri-Centennial Celebration of the Landing of Columbus.

To the Editor of Engineering News:

Sir: The advocates for the International World's Fair being held in New York in 1892 maintain that if the site selected had been in New York, the work of preparation could have been effected by the date named, while Chicago is obviously unable to make such progress, and is now clamoring for additional time on varied pleas, which, if admitted as just, will needlessly postpone to 1893 or '94 the celebration of an event which chronologically should take place in 1892.

Setting aside the question as to which city would best secure the advantages proposed by the exhibition, I would beg leave to emphasize what you as a professional man well know, in view of what has already been done in this direction elsewhere, that to open a properly equipped *International* exposition, with anything like the completeness of detail which such an enterprise would call for, in *two* years from the date of its inception, is simply impossible, with all our boasted go-a head-a-tive-ness. And the attempt should be discountenanced by all who have the good name of their countrymen at heart.

To celebrate the event of the landing of Columbus at the proper date, and still leave ample time for the preparation of the exhibition, the following is proposed:

Columbus landed Oct. 14, 1492, on Watling Island, a small island some 70 or 80 miles eastward of Cat Island, or what has been known as San Salvador. This island, one of the Bahamas, is some 400 miles or more in an air line in a direction east-southeast of the coast of Florida, to windward and in the track of the great southeast gales as they approach our coast, and the locality would form a valuable outpost to our extended signal service system, supposing it to be connected to the main land by cable.

Wherever it may be decided to hold the fair, let the work of preparation proceed without reference to any early day of opening. Let the State Department at Washington be authorized by Congress to negotiate with the British Government for the right to purchase a few acres of this island for international use as a signal station, etc. On Oct. 14, 1892, let a commission, consisting of State officials and others as may be thought desirable, appointed by Congress, land on this island, at the traditional spot of Columbus' landing, without "trick of drum" or any military display calculated to offend the jealousy of English officials, but as a civic body purely, and let them proceed to lay the corner-stone of a simple marine structure commemorative of the event of the day, and to be utilized as a station in our signal service system for all time to come, its benefits as such ultimately extending by private cable lines to any of the adjacent islands of the group (as an equivalent for conceded privileges from the British Government) and also to the main land; the station exempt by treaty stipulation from taxation or the ravages of war. This commission then and there assembled shall discuss the situation, and formally proclaiming the purpose of the landing, and providing for the construction and equipment of the station, shall *adjourn* to a *place* and *date*, where and when the completed ceremony of the inauguration of the event, to which this is but a prelude, shall take place, and in which all nations shall be invited to participate.

The appropriateness of this method of anticipating the crowning ceremonies of the opening of the World's Fair admit of much elaboration, of which I spare you the recital with one remark, that the obvious mutual advantages to British as well as American commerce growing out of the existence of such a signal station, and the growing comity between nations speaking the same language, will prevent, it is believed, any obstacles being thrown in the way of its establishment, and its maintenance by the American people, in view of its International use; and thus we may hope to celebrate the landing of of Columbus at the appropriate place and date, while the needful time is thus obtained to render this great fair worthy of the age and the nation. Julius W. Adams.

155 Congress St., Brooklyn, March 24.

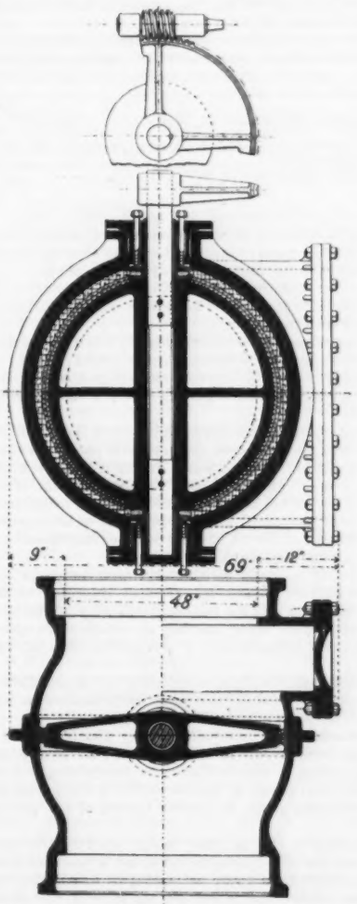
New Types of Valves and Fire-Hydrants.

The illustrations given herewith show two appliances of late design made by the Stillwell Manufacturing Co., of Philadelphia. The fire-hydrant is of the "Keystone" pattern, as made for some years by this same firm and illustrated in our issue of Feb. 12, 1887, in connection with our articles on the "Municipal Engineering" of Philadelphia. But in the present hydrant there is this important change; instead of the valve being pushed vertically downward by its stem and to a considerable extent blocking the free passage of the water, this new valve is so hinged to the side of the case that the downward push of the stem throws the valve entirely to one side and entirely out of the way of the free passage of water.

The appliance is simple and efficient, and the slight increase in number of parts is compensated for by the gain in capacity and freedom of flow. The hydrant is beyond the reach of frost, and can be withdrawn for any repairs without being dug up. The makers disapprove of an all metal valve, and deem the entirely removable gum valve, here shown, much superior to the valves ordinarily in use.

The swing gate, rotary, or butterfly valve, illustrated, is made in all sizes, from 20 ins. to 48 ins. diameter. It is designed for special use on street mains at points were the ordinary valve could not be applied. It takes up but little space, and the body of the valve in no case exceeds by more than 8 ins. the diameter of the main with which it is employed. The elevation and section show the design with sufficient clearness.

The same firm makes a four and five-way valve, not illustrated, which has peculiar advantages in



48-in. Rotary Valve: Stillwell Manufacturing Company.

pipe distribution. By the use of this valve at four-way intersections, from three to five ordinary two-way valves can be dispensed with, a gain in first cost and maintenance that scarcely need be pointed out. These same hydrants dispense with the use of a single branch to fire hydrants, and at intersections of mains they insure a complete circulation of the water, equalizing the pressure and displacing the sediment which settles in the bottoms of ordinary valve bodies. For the details of these valves, and any other information, we must refer our readers to the makers, the Stillwell Manufacturing Co., of 764 and 776 Swanson St., Philadelphia.

The Final Inspection Report on the Forth Bridge.

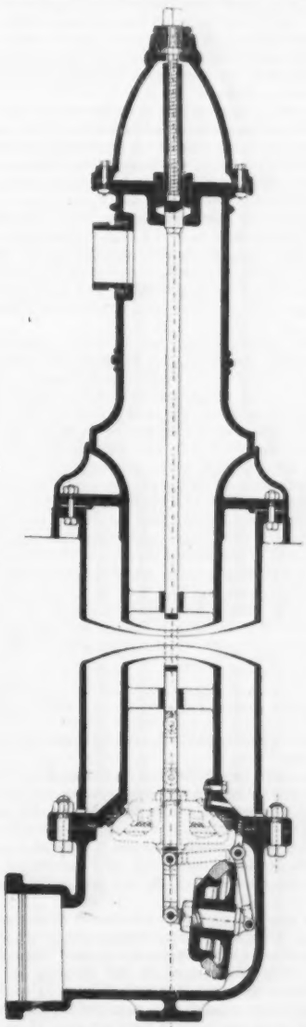
The twenty-eighth and final quarterly report of Maj. Gen. Hutchinson, R. E., on the Forth Bridge is really a condensed description of the bridge, and as such is valuable. We give it in full as follows:

Railway Department, Board of Trade, Whitehall, London, S. W., 24th February, 1890.

Sir: We have the honor to report, for the information of the Board of Trade, in compliance with the instructions contained in your "Minutes" of the 28th October, 1882, and 4th February, 1890, and in accordance with the provisions of the Forth Bridge Railway Act of 1882, we have made our twenty-eighth and final inspection of the bridge over the Firth of Forth at Queensferry, which was commenced in April, 1883, and has just been completed.

The bridge, with its approach viaducts, has a total length of 8,295 ft. 9 ins., and there are two spans of 1,710 ft., two of 680 ft. 6 ins., fifteen of 160 ft., four of 57 ft., and three of 25 ft.

The approach viaduct at the south end, which is 1,993 ft. 8 in. in length, has four masonry arches of 57 ft. span, and 10 spans of 160 ft, with steel lattice girders upon piers of granite, with concrete and rubble masonry backing.



The Keystone Fire-Hydrant; Stillwell Manufacturing Company.

These piers have concrete foundations upon boulder clay or hard sandstone rock, and the highest of them has a height of 139 ft. above ground level.

The approach viaduct at the north end, which is 980 ft. 5 in. in length, has three masonry arches of 25 ft. span, and five spans of 160 ft., with steel lattice girders upon piers, similar to those of the south approach viaduct. These piers have concrete foundations on greenstone rock, and the highest of them has a height of 130 ft. above ground level.

The bridge proper, which is 5,321 ft. 8 ins. in length, has two spans of 1,710 ft. over the two deep-water channels, one on each side of Inch Garvie, and two spans of 646 ft. 4 in., that at the south end being over shallower water, and that at the north end over dry land at North Queensferry.

The superstructure of these four main spans is composed of three great double cantilevers, built entirely of steel, the central or Inch Garvie double cantilever having a length of 1,627 ft. 8 ins., and the South Queensferry and North Queensferry—or Fife—double cantilevers having each a length of 1,513 ft. 9 in.

The intervals of 346 ft. 5 ins. between the north end of the South Queensferry cantilever and the south end of the Inch Garvie cantilever, and between the north end of the Inch Garvie cantilever and the south end of the North Queensferry cantilever, are each spanned by lattice girders 350 ft. in length, and 30 ft. in depth at their centres, supported by the ends of the cantilever arms.

The compression members of the cantilevers are, as a rule, tubular, the principal ones having a diameter of 12 ft., and the tension members are mostly lattice girders.

Each of the cantilevers rests upon a group of four low piers, built of masonry faced with granite, 49 ft. in diameter—except the two north piers at North Queensferry which are 45 ft. in diameter—having their tops 18 ft. above high-water mark. These piers are founded upon solid rock, or on concrete built up either from the solid rock or from a stratum of very hard boulder clay. They are arranged in pairs, 120 ft. apart from centre to centre transversely across the bridge, and the north and south pairs are 270 ft. apart from centre to centre at Inch Garvie, and 155 ft. apart at South and North Queensferry.

The south end of the southern cantilever and the north end of the northern cantilever rest upon granite piers, which also carry the ends of the adjacent girders of the two approach viaducts.

The four South Queensferry main piers are founded upon the boulder clay underlying the bed of the Firth upon the south shore, into which clay they are sunk to depths varying from 30½ ft. to 45 ft., and their bases stand at levels varying from 44 ft. to 90 ft. below high-water mark.

The four Inch Garvie main piers are founded under water upon greenstone rock, their bases standing at levels varying from 26 ft. to 72 ft. below high-water mark.

Of the four North Queensferry main piers two only are in the water, with their bases respectively 19 ft. and 24 ft. below high-water mark, the other two being upon dry land. The whole of them are founded upon greenstone rock.

The two cantilever piers are built upon granite with rubble masonry backing; that at South Queensferry is upon the foreshore, and is founded upon boulder clay, at a level of 34 ft. below high-water mark, and that at North Queensferry is upon dry land, and is founded upon greenstone rock. The top of the former is 230 ft. 3 in. above ground level, and 280 ft. 9 in. above high-water mark, and that of the latter is 181 ft. above ground level.

The foundations of all the piers are excellent, and the whole of the masonry is of a very superior quality.

The deepest foundation, that of South Queensferry northeast pier, is 90 ft. below high-water mark, and the extreme height of the central portions of the three double cantilevers is 343 ft. above the top of the piers, and 361 ft. above high-water mark. The headway in the channels below the main spans is somewhat in excess of that required by Sec. 5 of the Forth Bridge Railway Act, the actual minimum at high-water spring tides being as follows:

	Ft.	ins.
For 500 ft.	150	10¾
" 900 ft.	128	8
" 1,100 ft	108	9

The headway prescribed in the act for these spaces is 150 ft., 125 ft., and 100 ft.

The permanent way, which is for a double line, is on the cantilevers carried upon an internal viaduct supported by trestles resting upon the bottom members; at the central portions of the main spans it is placed between the girders, and upon the approach viaducts it is above the main girders. It is throughout laid in longitudinal steel troughs, resting upon cross girders, and acting as rail guards.

The rails are made of Siemens-Martin steel, and of a bridge form. They are in 28-ft. lengths, and weigh 121 lbs. per yard, their ends being connected by joint plates 26 ins. in length. They are secured to the sleepers by wood screws, of which there are four at each joint in each rail, and twelve others placed 2 ft. apart on alternate sides. The longitudinal sleepers are of Rangoon teak, 12 ins. wide and 6 ins. deep, bedded upon and secured to crossbearers of teak, the spaces between which are filled in with creosoted pitch pine. Between the sides of the steel troughs and the longitudinals, teak wedges on the inside, and packing on the outside, have been inserted at every bearer.

The floor of the bridge is composed of steel buckle plates, upon which a coating of gravel ballast is laid.

Proper and sufficient provision has been made for expansion and contraction both of the rails and of the main members of the bridge.

The whole of the superstructure of the bridge and viaducts, with the exception of the seven masonry arches, is composed of open-hearth or Siemens-Martin steel, which, by the specification, had to satisfy the following tests: Strips cut lengthwise or crosswise to have an ultimate tensile strength of not less than 30 tons, and not exceeding 33 tons per sq. in. of section, with an elongation of at least 20 per cent. on a length of 8 ins. for all steel subject to tensile stresses; and of not less than 34 tons nor exceeding 37 tons, with an elongation of at least 17 per cent. for all steel subject only to compression.

Strips cut crosswise or lengthwise 1½ ins. wide, heated uniformly to a low cherry red, and cooled in water of 82 deg. Fah., to stand bending double in a press to a curve of which the inner radius is 1½ times the thickness of the steel tested.

The requisite certificate, signed by the engineers, that these tests have been carried out is attached.

Under the authority of the Board of Trade, dated Dec. 9, 1881, $\frac{R, 11,469}{81}$, the bridge has been made of dimensions calculated to withstand a strain due to a rolling load of two trains of fifty loaded trucks drawn by two engines, giving a total weight for each train of 892 tons, and to a wind pressure of 56 lbs. to the square foot. Under the combined strains arising from these, and from the dead load, the steel, being of special quality, was authorized to be subjected to a stress of 8½ tons per square inch when in compression, and 7½ tons when in tension.

The stresses on the bridge, as constructed, have been carefully calculated, and are, as a rule, considerably below these amounts, in no case exceeding 7.6 tons in compression, and 6.9 tons in tension, in the cantilevers; and 6 tons in compression, and 7.3 tons in tension, in the central girders.

The weight of steel actually used is 50,958 tons upon the main spans, and 3,118 tons upon the approach viaduct girders, making a total of 54,076 tons, of which 53,716 tons are riveted work.

The amount of masonry and concrete work is as follows: Granite, 640 300 cu. ft.; concrete, 64,315 cu. yds.; rubble masonry, 62,250 cu. yds.

At this, our final inspection, we have subjected every part of the bridge to severe tests, by running over it, and placing upon it, in various positions, two heavy trains, each made up as follows:

	Tons.
Two engines and tenders (in front), each weighing 73 tons	146
Forty-four trucks loaded with iron, each 15 tons, 10 cwt. gross weight	682
One engine and tender in rear	73
Total	901

Each of these trains covered a length of 896 ft. 5 ins.

We have observed the deflections upon the main members and other parts of the structure, and these have in all cases been smaller than might have been expected.

With the loads in position calculated to produce the maximum deflections, these in no case exceeded 7.65 ins. at the ends of the cantilevers.

The deflections of the central girders, when loaded so as to produce the greatest effect, did not exceed 1.58 ins.

The deflections of the internal viaduct girders, approach viaduct girders, and cross girders were of a very moderate amount.

Careful observations were made to test the rigidity of the vertical members over the cantilever piers, and under the influence of the above heavy live loads the movements were very small, the "pull over" in the direction of the length of the bridge in no case exceeding 2 ins. at the top of the vertical columns. There appeared to be no appreciable movement of the top of these columns in a direction at right angles to the length of the bridge.

The results are most satisfactory, and, taken in conjunction with the theoretical strength according to the calculations, and with the remarkable absence of vibration when the trains were running at considerable speed, prove that the bridge is one of exceptional strength and stability.

We are therefore able to report that the Forth Bridge may be safely opened for passenger traffic as soon as the approach railways have been completed.

The greatest wind pressures during the last quarter were registered on Jan. 26, 1890, and were as follows: On the large gauge at Garvie Castle, 18 lbs. per sq. ft.; on the small fixed gauge at Garvie Castle, 34 lbs. per sq. ft.; on the revolving gauge at Garvie Castle, 27 lbs. per sq. ft.

At the time of this gale the bridge was virtually completed, and the effect upon the structure is stated to have been no greater than would, according to calculation, be caused by a pressure of 10 lbs. per sq. ft. over the whole surface. The maximum pressures during the progress of the work, of which there is a reliable record, were on the 16th Nov., 1888, when the three gauges above mentioned showed pressures of 27 lbs., 41 lbs. and 35 lbs. respectively.

The total number of fatal accidents during the seven years which the bridge has occupied in construction has been 56. Although this loss of life is greatly to be deplored, the fact that it has not been larger on a work of such magnitude, with so large a number of men employed in dangerous positions, shows that no reasonable precautions for their safety have been omitted.

In conclusion, we think it right to record our opinion that this great undertaking, every part of which we have seen at different stages of its construction, is a wonderful example of thoroughly good workmanship with excellent materials, and that both in its conception and in its execution it is a credit to all who have been connected with it, bearing testimony to the ability of the engineers who have designed it, to the skill and resource of those who have superintended and constructed it, and to the zeal and courage of the workmen who have been employed upon it. We have, etc.,

C. S. HUTCHINSON, Major-General, R.E.
F. A. MARINDIN, Major, R.E.

The Assistant Secretary,
Railway Department,
Board of Trade.

THE MISSISSIPPI RIVER, at New Orleans, says the correspondent of the *Courier-Journal*, of Louisville, has traveled westward near 1,800 ft. within the last century, and is yet pushing in that direction in spite of modern levees.

More About Cement Barrels.

From a number of replies to the query of a correspondent concerning the cubic capacity of cement barrels, we give the following, in addition to our notes of Feb. 22:

Mr. CHAS. F. POWELL, C. E., says that "Notes on Building Construction," an English publication of 1879, gives the inside measurement of casks for Roman cement (originally Parker's) as: Length, 28 ins.; middle diameter, 16.5 ins.; end diameter, 15.5 ins., making capacity 3.32 cu. ft. The same work says that "Portland cement casks vary in size," but it gives 3.48 cu. ft. as the usual capacity.

According to D. K. CLARK, writes Mr. M. J. BUTLER, C. E., a barrel, U. S. measure, contains 31½ galls. of 231 cu. ins. each; hence the barrel would contain 4.21 cu. ft. Gen. GILMORE says a cask of cement equals 3.7 cu. ft. of paste.

Mr. L. Y. SCHERMERHORN, C. E., says that from a number of careful measurements made some years ago, he found a barrel of Portland cement of average fineness to weigh net 375 lbs., or 113 lbs. to a U. S. bushel of 1.2444 cu. ft. On this basis a barrel of Portland cement contains 4.129 cu. ft.

ONE of our numerous correspondents as to the dimensions of cement barrels makes the somewhat amusing statement italicized below:

Thousands of these cement barrels are manufactured in Detroit and shipped "knocked down" to England for Portland cement. The 400-lb. barrel contains 4 cu. ft. The 350-lb. barrel contains 3½ cu. ft. In other words, *they are manufactured to contain* 1 *cu. ft. per* 100 *lbs.* of Portland cement.

It is very kind of the barrels to hold just this even 100 lbs. per cubic foot through all their sizes; or perhaps it is the thoughtfulness of the manufacturers which secures the happy result. If so, it is a kind of thoughtfulness which only GILBERT and SULLIVAN could celebrate properly; for it is certainly as "greatly to their credit" as was the equal thoughtfulness of the man who

"——might have been a Roosian,
Or a Turk, or else a Proosian,
Or perhaps I-tal-i-an;
But greatly to his credit,
He remains an Englishman."

Tests of a Steam Excavator.

In November, 1887, a test was made of a Victor excavator (Stock's patent) manufactured by the Toledo Foundry & Machine Co., of Toledo, O. The test was made at Gnadenhutten, by Mr. R. W. BAYLEY, of the Pennsylvania R. R. Eleven gondola cars were loaded with 192 cu. yds. of gravel in 46 mins. actual working time. During about 30 mins. of observation, the speed of the machine was timed for each 4 dippers raised. The highest speed was 4 dippers raised in 1 min.; the lowest was 4 dippers in 1 min. 30 secs. The lift was 7 or 8 ft. above the loading track. The steam pressure was 85 to 90 lbs., and the machine was working very rapidly, requiring skill and good judgment to operate it.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Whitefield & Jefferson.—It is stated that work on the extension of this New Hampshire road to Berlin will begin at an early date.

Pennsylvania, Poughkeepsie & Boston.—At a meeting of the directors recently held it was voted to increase the bonded debt of this road $500,000 and the capital stock $250,000. The money is to be used to purchase new equipment and to make necessary improvements. The road is now in operation from Campbell Hall, N. Y., to Slatington, Pa., and surveys are in progress for an extension from Slatington to Harrisburg, Pa.

Western Maryland.—A press dispatch from Baltimore, Md., says:

The three Western Maryland R. R. extension bills have become laws. One of these provides the mode of construction of the Western Maryland Tidewater Company R. R. along Jones' Falls, in the city of Baltimore. Another bill gives leasing powers to the Western Maryland of part of the extension enterprise. The third bill relates to the construction of the Potomac Valley R. R., of the Western Maryland system, from Williamsport to Cherry Run, where it will connect with the Baltimore & Ohio. This Potomac Valley road is to be a link in the connection of the Baltimore & Ohio, Western Maryland, and Philadelphia & Reading R. R., by way of the Cumberland Valley and the city of Harrisburg. It will ultimately also bring the P. & R. R. R. to Baltimore over the Western Maryland tracks. Important railroad developments are expected to follow the enactment of these three railroad laws.

Raritan River.—It is expected that work will soon begin on the extension of this New Jersey road to Bound

Brook, N. J., a distance of about 7 miles. Work will also soon begin on a depot and terminals at New Brunswick. E. W. Harrison, of Fulton Building, Jersey City, N. J., is Chief Engineer.

Temiscouata.—A meeting of the stockholders of this company will soon be held to authorize the issue of bonds to the amount of $19,600 per mile upon the St. Francis Branch, extending from Edmundston, N. B., to the mouth of the St. Francis River, a distance of 35 miles.

Delaware & Hudson Canal Co.—It is announced that this company contemplates building a branch from Carbondale to Jefferson, Pa.

New York, Lake Erie & Western.—Work is expected to begin on the line from Honesdale to Carbondale, Pa., 14 miles, in about 2 months.

Grand Trunk.—A petition has been presented to the Canadian Government by the Lindsay and Toronto Boards of Trade, asking that a bonus be granted in aid of the proposed extension of the Victoria Ry. from Haliburton to Mattawa, Ont., a distance of about 100 miles. It is stated that the road would open up a region very rich in timber and minerals.

Pennsylvania.—An agreement has been reached between this company and the Elizabeth, N. J., City Council, by which the company is to elevate its tracks through the city. The cost of the proposed changes will be about $600,000.

Lehigh Valley.—Chief Engineer Paul S. King, of the Buffalo & Geneva has received 56 proposals for building the new road. The contract will not be awarded under a week or ten days. The bidders were as follows:

M. S. Coleman & Co., New York; Smith & Brown, New York; T. F. Ryan, Massachusetts; D. F. Minehan, Springfield, O.; Lewis M. Foss & Son, Rochester; Charles McFadden, Philadelphia; Ellsworth, Chapman & Co., Rochester; Everett & Casterton, Buffalo; J. K. Ryan & Co., New York; Andrews & Warner, New York; George S. Good & Co., Lock Haven, Pa.; Miller, Loomis & Co., Chicago; A. P. Bovier and P. E. Beardsley, Elmira; Thos. Collins, Philadelphia; Broadhead & Hickey, Newark, N. J.; M. Lally & Co., Detroit; J. H. Sullivan, New York; John R. Fisher, Harrisburg; L. Harbrecht & Co., Buffalo; B. P. Smith, Rochester; James S. Smith, Rochester; C. F. King, Pennsylvania; John G. Noakes and Smith P. Mott, Scranton, Pa.; John Shields, Flemington, N. J.; Ryan & McDonald, Baltimore; Richard Dooley, New Rochelle, N. Y.; Thomas H. Rickert, Pottsville, Pa.; Whalen Brothers & McGovern, Towanda, Pa.; Kerns & Bissell, Pottsville, Pa.; Paige, Carey & Co., Cleveland; Edward J. Hingston and William E. Carroll, Buffalo; Fogg & Scribner, New York; McArthur Brothers, St. Paul; Dick & Mantz, Hazelton, Pa.; Flynn & Fuller, Scranton, Pa.; John B. Reilly & Co., Lancaster, Pa.; Ward & Lary, Newburg, N. Y.; J. C. Rogers, New York; Breen & Henry, Eau Claire, Wis.; J. F. & W. R. Dolan, New Ringgold, Pa.; W. R. Haven & Co., Buffalo; R. A. Malone & Sons, Lancaster Pa.; John C. Sheehan and F. S. Cook, New York; John H. & Jerry R. Byron, Mt. Vernon, N. Y.; W. E. Dorwin, Owego; James D. Casey, Rochester; Drake, Stratton & Co., Pittsburg; T. T. Amory & Co., Poughkeepsie; D. McDermild & Co., Detroit; O'Brien & Clark, New York; James Rafferty & Co., East Java, N. Y.; Reynolds & Co., Rock Island, Ill.; Kenneth McLeod, New York; Dowling & Kennedy, Binghamton; M. P. Quinn, Pottsville, Pa., and William Cochlan, Brighton, Mass.

Flint & Pere Marquette.—This Michigan company has changed the Port Huron & Northwestern Ry. from East Saginaw to Port Huron, Mich., 90 miles, to standard guage this season. New road has been built from Yale to Chicago & Grand Trunk Junction, about 4 miles west of Port Huron, a distance of 25 miles, and a branch from Brown City south 5 miles. The company will have ample yard room at Port Huron in connection with the Chicago & Grand Trunk Ry., and will connect with the St. Clair Tunnel when completed. About 40 miles of logging road have been built by the company during the present season mostly in Clare, Gladwin, and Lake counties. This is only temporary road, which is shifted from place to place as the lumbermen demand. It is possible that the company will commence work upon a line from Novi to Detroit during the present year.

Projects and Surveys.

Zanesville Terminal.—A railway company by this name has been incorporated in Ohio.

Baltimore Belt.—The bill providing for the construction of this road has passed the Maryland Legislature, and now needs only the Governor's signature to become a law. The road is to run from Camden Station to Bay View Junction, in Baltimore, a distance of 7 miles. There will be a tunnel 1¼ miles long on the line. Samuel Rea is Chief Engineer.

Ottawa & Parry Sound.—Surveys are reported in progress on this Canadian road. The road is projected to run from Ottawa to Parry Sound.

Lebanon & Reading.—Incorporated in Pennsylvania to build a line of railway from Lebanon to Reading, 30 miles. J. N. Dubarry is President.

New York, Schenectady & Ogdensburg.—This company has been organized in New York to build a line of railway from Highland to Schenectady, N.Y., a distance of about 85 miles. The following directors were elected: C. J. Crounse, Clarksville; P. H. Flagler, Clarksville; Joseph Allen, Clarksville; W. A. Wasson, M. D., Greenville; W. S. Vanderbilt, Greenville; H. B. Whitcomb, Cairo; C. Du Bois, Palenville; Arthur Van Norman, Palenville; D. W. Jennings, Cairo; Cyrus Hinckley, Indian Fields; Edgar Snyder, Woodstock; H. H. Mead, Clarksville; Charles R. Knowles, Albany. W. H. Slingerland of Albany, N. Y., was appointed Chief Engineer.

Potomac River.—A bill has been introduced into Congress authorizing the construction of a short line of railway in the District of Columbia. The capital stock is $800,000. Among the incorporators are: Arthur Hurbert, B. F. McKall, Thos. M. Gale, J. Maury Dove, and Wm. H. Sholes.

Saratoga, Johnstown & Western.—The surveys for this proposed New York road have been completed and the maps and estimates made. The road as surveyed runs from Saratoga, N. Y., via Gloversville, Johnstown, and Dolgeville, to Utica, N. Y., a distance of about 101 miles. The average grade is 40 ft. per mile, and an otherwise very favorable line is stated to have been found. The estimated cost of construction is $2,854,000. It is stated that a company will be organized at once and a charter secured looking toward the early commencement of construction. W. J. Curtis, of Utica, N. Y., was the engineer in charge of the surveys.

Rochester & Honeoye Valley.—This company has asked for a commission to appraise the property along its route. The road is projected to run from Rochester, N. Y., via Brighton, Henrietta, and Rush, to Honeoye Falls. Henry D. McNaughton, of Rochester, is Vice-President.

Rensselaerville.—A press dispatch states that a meeting of citizens of Rensselaerville, N. Y., was recently held and steps taken for the construction of a railway from that place to the Delaware & Hudson Canal Co.'s R. R. It is stated that surveys have been made and that the line will be completed this season. Thos. Chadwick and Geo. L. Bouton, of Rensselaerville, are interested.

SOUTHERN.—Existing Roads.

Columbus Southern.—This road has now been completed from Columbus to Albany, Ga., a distance of 87 miles, and the first train passed over the line March 20. W. S. Green, of Columbus, Ga., is Chief Engineer.

Chattanooga, Rome & Columbus.—This company is reported to have under consideration an extension from Rome, Ga., to Canton or Gainesville, Ga.

Louisville Southern.—The charter of the Richmond, Nicholasville, Irvine & Beattyville R. R. Co. has been amended so as to allow of a further extension of its road. The road was to run from Versailles to Beattyville, 95 miles, and the amendment authorizes an extension through the counties of Owsley, Parry, Leslie, Letcher, Harlan, Bell and Knox to the Virginia State line.

Chattanooga Southern.—Arrangements have been completed whereby the road is to be built to Gadsden, Ala. It is stated that work will be commenced at once and the line completed as soon as possible. The people of Gadsden have subscribed $30,000 in aid of the enterprise.

Orange & Keyseville.—The Board of Supervisors of Prince Edward County, Va., has declared the bonds issued in aid of this company void.

Alabama Midland.—The revised location of the Montgomery, Tuscaloosa & Memphis R. R. will be completed in 30 days, and the second division, from Maplesville to Tuscaloosa, will immediately be put under construction. The work is generally heavy, with a 250-ft. iron bridge, and a large number of trestles. The tracklaying on the Alabama Midland R. R. from Bainbridge, Ga., to Montgomery, Ala., was completed Feb. 26, and the line will be ballasted and opened for traffic in a few weeks. Jas. M. Brown, 115 Broadway, New York City, is the contractor.

East Tennessee, Virginia & Georgia.—The Briarfield, Blocton & Birmingham R. R. is now completed from Montevallo to Blocton, Ala., with the exception of about 1 mile and the construction of a few small bridges.

Seaboard Air Line.—Work on the Georgia, Carolina & Northern R. R. is in progress all along the line from Clinton, S. C., to the Savannah River. Surveys are in progress from the Savannah River to Atlanta, Ga., and the contracts for this portion of the line will be let in a few weeks.

Charleston, Cincinnati & Chicago.—Contracts for that part of the Augusta Division of this road between Blacksburg and Newberry, 70 miles, are to be let soon. Construction in Union County, S. C., will be started at once. A. N. Molesworth, Union, S. C., is Chief Engineer.

East & West R. R. of Alabama.—Proposals for clearing and grading 8,700 ft. of roadbed, comprising about 55,000 cu. yds. of earth excavation, are asked by this company. Chas. P. Ball, of Cartersville, Ia., is the Receiver.

Richmond & Danville.—Grading on the Murphy Branch of the Western North Carolina R. R. has been completed to the Somatia iron mines, 6 miles from Murphy, N. C. Surveys are now in progress through Murphy to a point on the Marietta & North Georgia R. R. on the south side of the Hiawassee River.

Projects and Surveys.

Cincinnati & Atlantic.—Incorporated in Tennessee to build a line of railway from some point on the line of the Knoxville Southern R. R., in McMinn County, north through the counties of Loudon and Roane, to a connection with the Cincinnati Southern R. R. near Craney Creek, Roane County.

Walterboro & Yemassee.—The Walterboro Construction Co. has been organized to construct this North Carolina railway. The road is projected to run from Walterboro to Pregnalls, a distance of 25 miles. The officers of the Construction Co. are: President, J. J. Cummings; Vice-President, A. Wichman; Secretary, A. S. Barrow, and Treasurer, J. Lamb Johnston.

Fincastle & Southern Botetourt Development Co.—This company has been organized in Virginia to build a railway from Fincastle to Troutville, 15 miles. William B. Simmons is President and Geo. Swann is Secretary.

Fredericksburg & Northern Neck.—A press dispatch says: A large meeting of the representative men of the Northern Neck of Virginia was held at Fredericksburg Thursday, having for its object the furtherance of the scheme for the construction of a railroad from Fredericksburg, through the counties of Stafford, King George, Westmoreland, Northumberland, Richmond, and Lancaster, to a point at or near the the mouth of the Rappahannock. A charter for this road was granted at the recent session of the Virginia Legislature, the incorporators being among the most enterprising and progressive citizens of the Northern Neck counties, including Mr. J. E. R. Crabbe and Rev. W. W. Walker, former residents of Baltimore. These counties, with one exception, are now entirely without railroad facilities, and it is an inviting field for enterprise. With a railroad penetrating the entire length of the Northern Neck it is believed that the lands would rapidly enhance in value.

Rome & Taylor's Ridge.—A company has been formed at Rome, Ga., to build a short line of railway from that place, to Taylor's Ridge and other ore banks. It is stated that work will begin at once.

Bellton, Homer & Carnesville.—The officers of this Georgia company are: President, Madison Bulce; First Vice-President, Lemuel N. Tribble; Second Vice-President, Thos. F. Hill; Treasurer, P. F. Farr, and Secretary, P. M. Edwards. The road is to run from Tate, on the Marietta & North Georgia R. R., via Bellton and Homer, Ga., to Carnesville, Ga., a distance of about 75 miles.

Pittsburg & Virginia.—Surveys, it is stated, will commence on this road in a few weeks. F. E. Montague, of Clifton Forge, Va., is Chief Engineer.

Bowling Green & Northern.—A recent press report from Bowling Green, Ky., stated that work would begin on this road March 20. The road is projected to run from Bowling Green to the Chesapeake, Ohio & Southeastern R. R., a distance of 40 miles. M. H. Crump, of Bowling Green, is Secretary.

Pineville, Mt. Pleasant & Big Stone Gap.—Chartered in Kentucky to build a railway from Pineville, Ky., through Leslie, Perry, Letcher, Harlan, and Knott or Pike counties to West Virginia. Among the incorporators are: W. F. Hall, Saml. Howard, Wright Kelley, and Jas. H. Middleton.

Louisville, Covington & Cincinnati.—Incorporated in Kentucky to build a time of railway through the counties of Boone, Kenton, Gallatin, Carroll, Trimble, Oldham and Jefferson, to Louisville, Ky.

Burksville & Northeastern.—This company has been organized in Kentucky to build a line of railway from Burksville, Ky., to either Glasgow or Horse Cave. The first line will be about 50 miles long and the other about 58 miles. Surveys, it is stated, will be commenced at once and the line is to be completed by Dec. 1. The route is through a fine mineral and timber region. The officers of the company are: President, W. F. Alexander, of Burksville, Ky.; Vice-President, W. C. Nones, of Louisville, Ky., and Secretary and Treasurer, J. P. Frank, Jr., of Burksville.

Virginia.—The following railway bills have been introduced into the Virginia State Legislature during the present session: To incorporate the Harrisburg & Elkton Ry. Co., the Tye River and Rockfish Valley Ry. Co., the Blacksburg R. R. Co., the Basic City, West Virginia & Pittsburg Ry. Co., the Augusta & Rockbridge R. R. Co., the Virginia, Missouri & Western R. R. Co., the Norfolk & Richmond R. R. Co., the Broadway & West Virginia R. R. Co., the Radford & Little River R. R. Co., the Norfolk Belt Line R. R. Co., the Portsmouth & South Mills R. R. Co., the Potomac Western R. R. Co., the Brookland Ry. & Improvement Co., the Potomac & Ohio R. R. Co., the Roanoke, Fincastle & Clifton Forge R. R. Co., the Pittsburg, West Virginia & Potts Valley R. R. Co., the Georgetown & Falls Church R. R. Co., the Caroline R. R. Co., the Portsmouth & Smithfield Ry. Co., the Portsmouth Park Ry. & Development Co., the Metropolitan Western R. R. Co., the Washington & Mt. Vernon Ry. Co., the Alexandria & Mt. Vernon Ry. Co., the Albemarle Mining, Manufacturing & Ry. Co., the Fincastle & Southern Botetourt Development Co., the Richmond, Manchester & Petersburg Ry. Co., the Abingdon Ry. Co., the Appomattox, Buckingham & Cumberland R. R. Co., the Roslyn, Arlington, Alexandria & Mt. Vernon R. R. Co., the James River & Rockfish Gap Valley R. R. Co., the Northwest & Southwest R. R. Co., the Salem Hunt Ry. Co., the Potomac & Piedmont Ry. Co., and the Appalachian Belt Ry. Co.

Carolina Southern.—This road is projected to run from Chiran, N. C., to Sumter, S. C., 65 miles. W. G. Childs, of Columbia, S. C., is President, and Wm. Moncure, of Durham, N. C., is Chief Engineer. Chas. C. Wilson, of Columbia, S. C., has been put in charge of the surveys, which will be commenced April 1.

Georgia, Tennessee & Illinois.—This company has been organized in Georgia with the following officers: W. B. Thomas, President; R. L. Spencer, Vice-President and General Manager; J. M. McBride, Treasurer, and J. H. Plummer, Secretary. Surveys will begin at once from Tallapoosa, Ala., to Ft. Payne, Ala., 100 miles.

Charleston, Sumter & Northern.—The contract for the branch from Eutawville to Pond Bluff, S. C., has been awarded to Robert S. Pringall, Summerville, S. C.

NORTHWEST.—Existing Roads.

Minneapolis, St. Paul & Sault Ste. Marie.—The people along the route of the partly graded Aberdeen, Bismarck & Northwestern R. R. are endeavoring to induce this company to complete the road and put it in operation. The road runs from Aberdeen, So. Dak., to Bismarck, No. Dak., a distance of 160 miles, and the grading was nearly completed about two years ago, since when no further work has been done. The road is now owned by the above company.

Duluth & Winnipeg.—It is stated that Foley Bros., of St. Paul, Minn., have taken the contract to build this road from the Mississippi River to the International boundary.

Chicago, St. Paul, Minneapolis & Omaha.—The annual report of this company for the year ending Dec. 31, 1889, shows the following result from operations:

Gross earnings	$6,417,857
Operating expenses	4,484,442
Net earnings	$1,933,415

Projects and Surveys.

Omaha, Superior & Southwestern.—We have received the following data concerning this enterprise from Clark A. Smith, of Cawker City, Kan.:

The company was incorporated March 3, 1890, to extend the railway already built from Omaha, Neb., to Superior, Neb., southwest, via Mankato, Cawker City, and Osborne, Kan., a distance of about 200 miles. The surveys for the line will commence about April 1. The work will be very easy. F. P. Bonnell, of Superior, Neb., is President.

St. Paul, New Ulm & Southwestern.—The project of building a line of railway from New Ulm to St. Paul Minn., has been revived. The line was surveyed some time ago and a very favorable road was reported to have been secured. W. C. Berdenhagen, of St. Paul, Minn., is President.

Chicago & New Orleans.—Vice-President S. S. Burger, of Eddyville, Ill., states that construction will soon begin on this road. The road is projected from a point on the Ohio River in the vicinity of Metropolis, Ill., and Paducah, Ky., directly north 150 miles to Shumway, on the Wabash road, in Effingham County, or to Edgewood, on the Illinois Central, in the same county. The greater part of the line lies through a region in Southern Illinois which is destitute of railroad facilities. The contract for the grading is understood to be let to F. D. Hustis, of Crawfordsville, Ind.

SOUTHWEST.—Existing Roads.

Chicago, Burlington & Quincy.—Surveys are reported in progress for an extension from Bogard Mound, Mo., to Liberty, Mo. The object of the proposed extension is to shorten the distance between Kansas City and Chicago. The route is through rich coal fields, and it is expected that the line will be completed by July.

Eureka Springs.—At a meeting of the stockholders recently held the following officers were elected: President, Powell Clayton; Vice-President and Treasurer, Logan H. Roots, and Secretary, A. H. Foote. It was resolved to authorize the extension of the road east from its present terminus, 50 miles, to Harrison, Mo. Two surveys have been made for the extension.

Wichita Valley.—A press dispatch from Wichita, Tex., states that the rails have begun to arrive and that the construction force has been increased. Morgan Jones, of Ft. Worth, Tex., is President, and P. H. McCrickett, of Wichita Falls, Tex., is Chief Engineer.

Union Pacific.—A press dispatch quotes Vice-President Holcomb as saying that this company will broad gauge the Kansas Central, which runs west from Leavenworth, for 165 miles. Track arrangements will then be made with the Missouri Pacific from Leavenworth to Kansas City. The Union Pacific is to give the Missouri Pacific the right to enter Omaha over its tracks, and in return is to run Kansas Central trains to Kansas City over the Missouri Pacific tracks. The Wood River branch of the Union Pacific in Idaho is to be extended 65 miles northwest of Kearney and Cheyenne, and the Northern is to be built 20 miles from its present terminus to a connection with the Northwestern, thus completing the Black Hills, Denver & Gulf system.

Missouri Pacific.—The annual report of this company for the year ending Dec. 31, 1889, shows the following results from operations, as compared with the previous year:

	1889.	1888.
Gross earnings	$23,493,467	$22,189,453
Operating expenses	15,532,883	15,852,842
Net earnings	$7,960,584	$6,336,611

During the year the Kansas & Arkansas Valley R. R., from Coffeyville, Kan., to Wagoner, Ind. Ter., 82 miles, was built. Under the head of new construction and improvements the report says:

Since the close of the year a contract has been let by the Kansas & Arkansas Valley Ry. Co. for the construction of a railway, wagon, and foot bridge across the Arkansas River at Fort Smith, connecting the Little Rock & Ft. Smith, the Kansas & Arkansas Valley, and the Greenwood Branch lines. The work of constructing the bridge foundations is now in progress, and the structure is expected to be completed during the present season.

The construction of the Ft. Scott & Eastern Ry. from Ft. Scott, Kan., to Rich Hill, Mo., a distance of 25 miles, was commenced in the month of December, 1889, and when completed will afford an independent connection between the branch lines terminating at Ft. Scott and the numerous lines of the Missouri Pacific system. Several miles of terminal tracks are also under construction in the city of Ft. Scott, under the auxiliary charter of the Ft. Scott Belt Terminal Ry., including a new bridge over the Marmaton River, reaching the property and tracks of the Ft. Scott, Wichita & Western Ry. The Ft. Scott & Southern Ry has been chartered to contruct a line southeastwardly from Ft. Scott to the coal fields near Minden, Mo., a distance of about 140 miles. The Houston, Central Arkansas & Northern Ry. * * * is engaged in the extension of its road northwardly through Arkansas to a connection with the Warren Branch of the St. Louis, Iron Mountain & Southern Ry. at Dermott, Ark., and with the main line of the same road at McGehee, Ark., and has also projected its line southwardly to a connection with the Texas & Pacific Ry. at or near Alexandria, La., making the total approximate length of line from McGehee to Alexandria 175 miles, with a projected branch from Bastrop, La., to Natchez, Miss. * * *

The Omaha Southern Railway has been chartered for the construction of a low grade river line from a point near Nebraska City, via Plattsmouth and New Fort Omaha, to South Omaha, Neb., a distance of about 25 miles, and the surveys and preliminary arrangements are in progress for its construction during the present year.

Arrangements are in progress for an early completion of the low grade line from Jefferson City to Lexington, Mo. That portion of the line extending from Lexington to Boonville, a distance of 79 miles, was completed in 1888. The construction of the remaining distance from Boonville to Jefferson City, 40 miles, will furnish The Missouri Pacific Ry. practically a double track between Jefferson City and Kansas City, with grades not exceeding 16 ft. to the mile, and, it is estimated, will effect a saving in operating expenses, based on tonnage of 1889, of a quarter of a million dollars per annum through the economy of train service rendered possible by the lower grade of this line compared with the lines over which the through traffic is now routed.

Projects and Surveys.

Sherman & Ardmore.—A company will soon be organized to build a line of railway from Sherman to Ardmore, Tex., a distance of 53 miles. The surveys have been completed, and it is expected that the road will be completed in about 1 year.

St. Louis, Kennett & Southern.—Incorporated in Missouri to build a line of railway from Campbell to Kennett, Dunkin County, Tex., a distance of 18 miles. The directors of the company are: A. J. Kerfoot, of Alton, Ill.; E. S. McConley, of St. Louis, Mo.; Henry H. Ferguson, of Alton, and Melvine L. Long and Geo. Dennison, of St. Louis.

ROCKY MT. AND PACIFIC.—Existing Roads.

Great Northern.—Surveys are in progress for the extension of the Neihart Branch from Monarch, Mont., to the mining camp of Neihart and Baker, a distance of 15 miles.

Oregon & Washington Territory.—It is reported that work has been commenced on the extension from Dayton to Whetstone Hollow, Wash., 12 miles. The $100,000 asked by this company in aid of the extension from Centralia to Gray's Harbor, Wash., has been raised, and the road is to be built at once, it is stated.

Port Townsend Southern.—At a meeting of the stockholders, recently held, the company was organized under a new management. The following officers were elected: Elijah Smith, of New York, President; H. W. McNeill, of Seattle, Vice-President; H. McLellan, Secretary of the Oregon Improvement Co., Treasurer; Struve, Haines & McMicken, of Seattle, Attorneys. Directors, Elijah Smith, Prosper W. Smith, James H. Benedict, of New York; Charles Eisenbeis, Thomas Jackman, Port Townsend; H. W. McNeill and Col. J. C. Haines.

In an interview President McNeill is quoted as saying:

I have already arranged for surveying parties to work on the line, and the work will be under contract before next Monday. We are bound to finish the first twenty miles from Port Townsend south by Sept. 1, and expect to finish the whole line next season without trouble. The work will be in charge of F. A. Hill, who has again entered the company's service. Our outfit in the Skagit valley consists of 1,000 men, and we will double that number probably so as to build the line fast. We have good terminals and a strong position in Seattle, which you may say it is not the intention of the Oregon Improvement Co. to waste. Our position we consider a strong one, and we intend to complete the line as fast as possible. As for stopping in Seattle or going to Portland, I cannot say now.

Projects and Surveys.

Astoria, Seashore & Eastern.—Incorporated in Oregon to build a line of railway from Astoria, via Fairfield, Ft. Clatrop, and Tilamook, to San Francisco, Cal., with branches to Portland and points in the Willamette Valley. Among the incorporators are: W. H. Smith, Oliver Stewart, E. C. Jeffers, and D. M. Stewart, of Astoria, Ore., and Geo. Eckler, of Dayton, Wash.

Bay.—Chartered in Oregon to build a line of railway from Astoria to a point on the Walluski River. Incorporators, Jas. Taylor, E. A. Taylor, and Frank Taylor.

New Mexico.—A press dispatch from Santa Fe, N. M., contains the following concerning the proposed railway construction in this Territory:

At the present time active work is in progress on five different railroad projects in New Mexico, and this work is of such a nature as to make it reasonably certain that these lines will all be completed during the present year. They comprise the line designed to begin at some point north of Albuquerque and connect the Rio Grande Valley with Durango, Colo., and covering a distance of about 190 miles; the Pecos Valley Railroad, reaching from Roswell via Eddy to the Texas & Pacific road, 185 miles; the Fort Worth, Union Pacific extension, from Trinidad through the Maxwell land grant, toward Las Vegas or Taos Valley; the Atchison, Topeka & Santa Fe extension, from Ortez Station to San Pedro, and the Santa Fe Southern Narrow Gauge, from Santa Fe via Cerillos to San Pedro. These enterprises, if carried out, will increase the railway mileage about 550 miles. They cover sections of the Territory that are in great need of railway facilities, and there are business reasons why they should be built.

Terminal Syndicate Co.—This company has been chartered in Washington by H. W. McNeill, J. F. McNaught, A. W. Engle, Howard H. Lewis, and Rufus H. Smith, to build and operate railways and steamships.

RAPID TRANSIT.

Electric Railways.—The Pawtucket St. Ry. Co., of Pawtucket, R. I., has applied for power to adopt electric traction.

The Woonsocket, St. Ry. Co., of Woonsocket, R. I., has voted to adopt electric traction. Contracts have been made with the Thomson-Houston Electric Co., for plant and equipment, and with the Woonsocket Electric Machine & Power Co., for power.

The Julien Electric Co. will equip its storage battery cars on the 4th Ave. line, New York, with batteries on the Brush system.

The Brooklyn City & Newtown Ry. Co., of Brooklyn, N. Y., proposes to introduce electricity on the De Kalb Ave. line.

The Washington & Marlborough Electric Ry. Co., has been organized to build a line from Washington, D. C., to Marlborough, Prince George's county, Md. Delegate Meory, of that county, is interested.

The East Cleveland Ry. Co., of Cleveland, O., will extend its Collamer electric line to Collinwood.

A storage battery car, fitted up by the Detroit Storage Battery Co., of Detroit, Mich., is in operation at Pullman, Ill.

The Cross Town Electric Ry. Co., of St. Louis, Mo., has been incorporated by E. D. Meier, D. K. Ferguson, P. K. Marion, and others. Capital stock, $100,000.

The Sedalia Electric Ry., Light & Power Co. will build an electric line 2 miles long on 3d St.

At Helena, Mont., the Helena & Broadwater Hotel, Electric Ry. Co. has been organized. President, Frank Longford; Secretary, C. A. Broadwater.

Cable Railways.—The Brooklyn Heights Ry. Co., of Brooklyn, N. Y., will build a cable railway from Wall St. Ferry along Montague St. to Court St.

It is stated that the cable system on Seventh St., at Washington, D. C., will be extended so as to include the 14th St. line.

The Cleveland City Cable Ry. Co., of Cleveland, O., will extend its line along Hough Ave. to Wade Park. Two iron bridges will be built.

Street Railways.—The Park Commissioners, of New York, N. Y., have awarded the contract for the construction of a surface railway across Central Park through the transverse road at 85th St., to the Johnson Co., of Johnstown, Pa., at $11,950.

The Washington Bridge, Tremont & Westchester Ry. Co. has applied to the New York Board of Aldermen for permission to build a horse railway from the Washington Bridge through Aqueduct Ave., MacComb's Dam road, Tremont Ave., etc., to the Westchester Ave. bridge at West Farms. Mr Wm. H. Schott is President.

The Post Office & Schenley Park Passeager Ry. Co., of Allegheny, Pa., has been incorporated, President Wm. G. McCandless, of Allegheny. Capital stock, $36,000.

The North & South Rapid Transit Ry. Co., of St. Louis, Mo., has been incorporated by L. J. Holthaus, James Campbell, Wm. F. Reed, August Gehner and John G. Kelly. Capital stock, $100,000.

HIGHWAYS.

New York.—At the session of the State Society for the Improvements of Roads, at Utica, March 18, a constitution and by-laws were adopted. The Committee on Legislation reported that a beginning should be made at once by improving the roads of the State, and recommending the passage of Senator Richardson's bill, now before the Legislature, in case it is so amended as to provide for the maintenance of the roads improved by the State; also endorsing the Weller bill, enabling counties to improve their roads by establishing county roads. The following officers were chosen: President, William A. Sweet, Syracuse; Vice-Presidents, A. W. Thayer, Cooperstown; Charles J. Edic, Marcy; John O'Donnell, Jamaica; A. Burlong, Schuyler; Arthur S. Hamilton, Rochester; Peter Collier, Geneva; Addis J. Loomis, Cicero; J. H. Durkee, Sandy Hill; J. H. Meyers, Plattsburgh; E. D. Mosher, Mapleton; A. B. Lawrence, Warsaw; C. M. Titus, Ithaca; William H. Robb, Amsterdam; N. W. Townsend, Bergen; Lewis E. Gurley, Troy: Trustees, W. H. Richardson, H. G. Coggeshall, F. O. Chamberlin, H. H. Freeman, T. E. Kinney, J. T. McClintock, T. R. Proctor, A. R. Egerton, and J. B. Weber; Treasurer, Charles W. Wood: Secretary, Isaac B. Potter.

Pennsylvania.—A meeting of Delaware County people was held March 15 at Philadelphia, to discuss the question of better roads. A committee was appointed to formulate a plan for concerted action by the citizens to improve the roads of the county. This committee consists of Richard Young of Morton, Edward W. Smith, of West Chester, Francis F. Eastlack, Charles M. C. Duburow and Mr. Hall, of Swarthmore. The committee will favor the appointment of a representative from each township in the county to meet at Media and confer with their representatives in the legislature to secure State aid for better-

ing the condition of the country roads. Each borough and township will look out for its own roads, and if the State will put the main thoroughfares in condition the question of good roads will be solved within three years.

Indiana.—The Commissioners of Putnam Co. will probably purchase the Greencastle and Crawfordsville gravel road, within the limits of Greencastle township.

Michigan.—The Detroit *Free Press* says: "The farmer is prone to think, because he cannot plow, sow or reap in winter, that whatever he and his horses can make is clear gain, and so be contented with half a loaf when he might have the whole. The same team that would be started with a ton behind them under present conditions would readily draw two tons on well-made and well-kept turnpikes, whenever there is not enough snow for sleighing, and when there is such a snowfall it would draw the two tons with equal ease on runners. So the farmer who has wood, hay, vegetables or the like for sale could accomplish twice as much in a day and double his profits with good roads. In the large villages and towns of Michigan there has been almost a famine for months past in farm produce, and the winter has been wasted for merchants and farmers alike, because the roads were fairly impassable. Here is work which should receive the attention of farmers' organizations all over the State."

Missouri.—In Jackson County it is proposed to issue bonds for $1,500,000 to build 300 miles of good macadamized roads, connecting Kansas City with other towns in the county.

Texas.—A new road machine has been received at Beeville, and has been put to work. The County Commissioners propose to keep the roads in repair as much as possible by taxation, and those subject to road work will only be required to work one day in the year instead of five as heretofore. This new order of things is said to give satisfaction.

West Virginia.—The County Commissioners at Moundsville, have awarded the contract for macadamizing the road to Benwood to Walter Dugan, of that place.

WATER-WORKS.

NEW ENGLAND.

South Berwick, Me.—The water supply project has been defeated by a citizens' vote.

Rockland, Me.—The Camden & Rockland Water Co. is negotiating for the stock and franchises of the Rockland Water Co.

Keene, N. H.—The City Council has appropriated $10,000 to substitute iron pipe for the cement water mains which have been used since 1870.

Derry, N. H.—The town has voted to contract with the Derry Water-Works Co. for hydrant service, for five years, at $2,000 per year. [An act incorporating this company passed the Legislature in July, and the company was organized in November, 1890. S. Pillsbury is President; E. J. Shepard, Treasurer.—ED.]

Berlin, N. H.—A water and sewerage system is to be constructed. Estimated cost, $100,000.

Southborough, Mass.—A committee is to be appointed to petition the General Court for an act to enable the town to take water from surveyed sources of supply.

Boston, Mass.—R. D. Wood & Co., of Philadelphia, Pa., have been awarded the contract for furnishing 1,400 tons of 6, 8, 10 and 12 in. pipe, and 100 tons of special castings, at $47.100.

Brockton, Mass.—The Board of Aldermen has passed an order authorizing a loan of $48,000, for the construction of a stand-pipe.

Hudson, Mass.—The town has been granted authority to make an additional loan of $25,000 for extensions.

Pittsfield, Mass.—The Water Commissioners will apply to the fire district at the coming annual meeting for authority to extend its pipes outside of the fire district.

Needham, Mass.—E. H. Bowers has kindly sent us the following information:

The Water Board is investigating sources of supply. The proposed plan is to pump water from springs, located in the Charles River Valley. Another plan is to contract with Wellesley or the City of Newton to supply a pipe system from their pumping stations, located near the town. No engineer has yet been appointed, and neither plan will be adopted until a full examination is made. The estimated cost of the works is $75,000, to be procured by town bonds. James McIntosh is Chairman, and John Moseley is Secretary of the Water Board. Population, 3,000.

Newton, Mass.—Proposals will be received by the Water Board, until April 18, for furnishing materials and constructing about 2,200 ft. of wooden filtering conduit ann driving pipe wells near Charles River, in the town of Needham, Mass. Albert F. Noyes, City Engineer.

Braintree, Mass.—The town is negotiating with the company for the purchase of the existing works. About five miles of extensions will probably be made if the purchase is made.

MIDDLE.

Rochester, N. Y.—The following is taken from the Rochester *Herald*:

The joint water-works committee, composed of representatives of the Common Council, and the Chamber of Commerce, have decided to recommend, first, the purchase of 10,000 water meters for use in this city at a cost not to exceed $150,000; and, secondly, that an enabling act be immediately prepared which will provide for securing to Rochester a new gravity conduit to Hemlock lake, with capacity for supplying the city with an additional daily supply of 15,000,000 galls. of water.

Northville, N. Y.—Charles Miller, of Johnstown, is surveying for a water supply. Of the two routes surveyed Hardscrabble has the advantage of Stony creek, since 125 ft. head can be easily obtained.

Granville, N. Y.—The Water Commissioners have decided to call a meeting of the taxpayers to vote upon the appropriation to extend the supply pipe to the water-works.

Ellicottville, N. Y.—Sufficient stock has been taken to insure the construction of a system of works. The water will be conveyed from springs to a 20,000-gall. wooden tank, to be located near the village. Work will be commenced early in the spring. Address C. A. Case.

Glens Falls, N. Y.—At the recent village election a resolution was passed authorizing the village trustees to issue an unlimited amount of bonds to lay new water mains said bonds to be payable at the rate of $8,000 per annum. Legal authorities have since given their opinion that the resolution, as passed, is illegal, and a bill to legalize it will be introduced in the Legislature at once.

Camden, N. J.—At a recent meeting of the Water Committee a proposition was received from the National Water Supply Co., of Cincinnati, O., guaranteeing that if an experiment which it proposes to make should prove a success, it would furnish the city with pure water at the rate of 16,000,000 galls. per 24 hours. The company offered to make a test on the city property with the driven well system for $2,000, providing the city would bear half the expense, and in the event of a success, for the city to enter into a contract.

Wilkes Barre, Pa.—The Wilkes Barre Water Co. proposes to improve its water supply.

Clifton Heights, Pa.—Sealed proposals will be received by S. P. Bartleson, President of the Clifton Heights Water Co., until April 15, for furnishing for the construction of the new works, cast-iron pipe, and for laying the same. Also, until April 29 for furnishing steam pumping machinery, building an engine house, and for constructing a reservoir. Specifications can be obtained from Dr. Bartleson, or Isaac L. Cassin, Engineer, 1404 North 12th St., Philadelphia, Pa.

McKeesport, Pa.—Superintendent Joseph Ecoff is preparing a report to be presented to the City Council urging that immediate steps be taken to have a big conduit extend from the pumping station to a point on the Yough River, about one mile above Christy Park, where huge springs bubble up through the sand at the bottom of the river. This pool will insure a supply of water for several years, and can be developed for a smaller amount than a pumping station can be constructed for.

Dunbar, Pa.—The citizens are trying to devise a mountain storage system that will secure for them a water supply during the entire year.

Cumberland, Md.—The following recommendation for purifying the water supply has been made by City Engineer James P. Gaffney:

That the old system of supplying the engines direct from the river, when the water is emptied from the cistern, be renewed. When this is done and an assured supply obtained, the cistern be completely emptied and thoroughly cleansed. Then a new 9-in. wall be laid inside, about one foot distant from the present wall, up to a sufficient height above the required water line in the cistern; the intervening space between the inner and outer walls to be filled with soft brick and grouted as the wall is being raised.

Cambridge, Md.—It is reported that C. F. Dieterich, of New York, and J. R. Clarke, of Baltimore, will build works.

Washington, D. C.—Water was turned into the new 48-in. main on March 20.

SOUTHERN.

Big Stone Gap, Va.—The Big Stone Gap Water Co. has been organized to supply the town with water. Capital stock, $200,000. President, William McGeorge, Jr., Bullitt Bldg., Philadelphia, Pa.

Aiken, S. C.—The Aiken Water & Light Co. has been incorporated to furnish water. Capital, $5,000. The corporators are: P. A. Emanuel, William Turnbull, George W. Croft, Henry Hahn and John F. Gaston.

Anderson, S. C.—The Anderson Water Supply Co. has begun work, and will push the works to completion as rapidly as possible, as their contract with the city calls for their occupation by July 1. Water will be pumped from Whitner's Creek to a stand-pipe, to be erected on Main St.

Atlanta, Ga.—The vote which was to have been taken on March 8, to decide the question of issuing $250,000 of bonds for increasing the city's water supply, will be taken on April 23.

Tallapoosa, Ga.—We have received the following from R. L. Spencer, Treasurer of the Tallapoosa Land Mining & Mfg. Co.:

Work will be commenced on April 15, and is to be completed in August. Woltmann, Keith & Co., of New York, have been awarded the contract. Estimated cost, $75,000. Water will be pumped into a stand-pipe.

Columbus, Ga.—Regarding the projected works at Rose Hill, F. D. Peabody, has sent us the following information:

Rose Hill was annexed to the city of Columbus about three years ago. But since the projected water supply is primarily to supply that section, the company has been organized under the name of the Rose Hill Water Co. The plan is to supply this and other suburbs, etc., having a combined population of about 35,000. The company has not been chartered as yet. The promoters are G. Gunby Jordan, L. H. Chappell, A. Ilgess, F. D. Peabody, and others. No accurate surveys for a source of supply have been made. Water will be pumped either from the Chattahoochee River, two creeks, or driven wells, to a stand pipe, or reservoir. Capitalists and others, desiring further information can secure it by addressing F. D. Peabody.

Florence, Ala.—The City Council has accepted the proposition of the Florence Water-works Co. to extend the system to East Florence, and work has been commenced.

Shelby, Ala.—The site for the water tower has been selected.

North Knoxville, Tenn.—The Woltmann Water Works Co., of New York, have accepted the amended ordinance as passed by the North Knoxville council with relation to water-works, and given bond in the sum of $5,000 for the faithful performance of the contract. The stand-pipe or reservoir is to be 20 ft. in diameter and 100 ft. high, and will be located on the hill at Sharp's ridge. The works are to be completed within 8 months.

Nashville, Tenn.—The new 10,000,000 gall. pumping engine, from the Holly Mfg. Co., of Lockport, N. Y., has been satisfactorily tested.

Covington, Ky.—It is reported that the City Council has voted to issue $120,000 of bonds to complete the reservoirs.

Winchester, Ky.—Bids will be received until April 10, for constructing works. Address, F. P. Pendleton, Mayor.

NORTH CENTRAL.

East Palestine, O.—Engineer J. B. Strawn, of Salem, O., informs us that the new works were accepted by the City Council on March 17.

Wellston, O.—Legislative authority to issue $50,000 of bonds has been granted to the town, and a citizens' vote to decide upon their issue will be taken on April 7.

Norwalk, O.—The $75,000 of bonds will be used, if carried on April 7, in practically establishing a new system of works. A new storage reservoir will be constructed, as well as a new pumping station, new pumps, and a stand-pipe erected, and a large amount of new mains laid. The new supply will be taken from Norwich Creek.

Eaton, O.—A bill is before the Legislature authorizing the citizens to issue $60,000 of bonds for establishing works.

Bridgeport, O.—The members of the Water Committee are: Dr. Dent, Dr. Fisher, N. Cuhn, R. Howell and City Solicitor McKee.

Bond Hill, O.—A bill has been introduced into the Legislature for authority to issue bonds for constructing works.

Canton, O.—The vote on the question of issuing $35,000 of bonds for improvements will be taken on April 7.

Sidney, O.—Bonds for $20,000 will be issued for extensions.

Martin's Ferry, O.—A settlement has been made between the Board of Water-Works Trustees and the Terminal Railway Co. regarding the big main from the power house to the reservoir. The trustees have a right of way of 20 ft. for the main through the DeHass farm, and the Terminal Railway people, in order to give an overhead crossing of 20 ft., as promised, on what will be Sherman street, built an abutment on the big main. This the company had no right to do, and the trustees got out an injunction stopping the work. The company has granted them 3 ft., which has been accepted. This will be on the north side of the pipe, and will allow room for the laying of the second main, which is included in Hibbard & Son's contract for the extension of the water mains, and will be laid this spring. The present main is 12 ins. in diameter, and the new one will be the same size. The new main will be used as an inflow main and the old one as an outflow pipe.

Martinsville, Ind.—We have received the following information from J. K. McIlhemy:

The City Council is prospecting to ascertain the probable cost of works. A proposition has been received from Chicago parties, offering to construct a system, if a 30 years franchise is granted to them. This proposition does not meet with the approval of the councilmen, they preferring to have some reliable party establish works, to be purchased by the town. The proposed sources of supply are springs, near the city, and White River. Marlow Bales is chairman of the Board. Population, 4,000.

Romeo, Mich.—Another vote is to be taken upon the question of establishing works.

Quincy, Ill.—It is proposed to supply the Court House and Jail with water from artesian wells.

Pecantonica, Ill.—Works are to be established. Water will be pumped to a stand-pipe. The Rockford Construction Co., of Rockford, Ill., has been awarded the contract for constructing the stand-pipe.

Jacksonville, Ill.—The Water Board has purchased 100 tons of 6-in. water pipe and special castings at 2½ cents per lb., from Shickle, Harrison & Howard, of St. Louis. They are to be used for new water mains, to be put down this summer.

Milwaukee, Wis.—Bonds for $500,000 have been sold to Charles Schley & Co., of Milwaukee, who, it is stated represented New York capitalists.

NORTHWESTERN.

Coon Rapids, Ia.—A. H. Henry is interested in the water supply project.

Sioux City, Ia.—The following recommendations are made by the superintendent in his annual report:

That a number of valves be placed in different localities, so that in case of a leak it will not be necessary to shut off large districts, as would now be the case. The

laying of new mains on Douglas St. from 18th to 24th Sts.; on the Boulevard from 12th to 19th Sts.; on West 17th to Rebecca, and north on Rebecca to 19th. Also to sink an open well at the pumping station, and to cover the reservoir to prevent the growth of fungi.

Litchfield, Minn.—Bids will be received by Richard Welch, Recorder, until April 1, for $25,000 of 15-year water bonds.

Atkinson, Neb.—The town is about to close a contract for the erection of a system of works to cost about $7,000, to consist of a pumping plant and stand-pipe. For the present there will be about 1,500 ft. of mains. Hydrants will be used.

Crawford, Neb.—We have received the following information:

There are no water works in this place. The town is desirous of having a system put in this summer. Address Charles J. Grable.

Lexington, Neb.—Regarding the report that works were projected, we have received the following:

There are no works in this place. A company was organized a year or two ago to put in a canal and water works, but the whole thing fell through.

Syracuse, Neb.—C. M. West has sent us the following:

If works are constructed water will be pumped, and hydrants used. Nothing has been determined or decided upon. Population, 1,000. Estimated cost, $5,000 to $10,000. Address W. F. Jennings.

Alexandria, So. Dak.—We have received the following:

An artesian well is being bored to ascertain whether water can be secured from this source or not. Address E. P. Brown.

Madison, So. Dak.—An artesian is to be put down. Address R. C. McAllister.

Vilas, So. Dak.—The following is from M. B. Willard:

The works, if put in, will be constructed by the town; the money to be raised by taxation. An artesian well is now being bored. Water will be used for fire protection and domestic supply.

Woonsocket, So. Dak.—There is talk of laying a mile of new mains. S. E. Hinds is Mayor.

Whitewood, Dak.—The new works will be put in operation about June 1.

SOUTHWESTERN.

Girardeau, Mo.—We have received the following:

Works are contemplated. Surveys have been made, and plans drawn, but there is a difference of opinion as to the town's legal right to incur the indebtedness necessary to establish works.

Lebanon, Mo.—The stockholders of the water company have decided to issue $48,000 of additional stock.

Wichita Falls, Tex.—We have received the following information from E. W. Abendroth:

The franchise for building water-works at this place was granted to E. W. Abendroth, Nelson Building, Kansas City, Mo., on March 22. The franchise calls for 35 hydrants, 4 miles of mains, stand-pipe, etc. The city pays $2,450 per year for the use of hydrants.

Waco, Tex.—The Lott Water Co. is reported to have been incorporated to build works in the new town of Lott. Capital stock, $30,000. The incorporators are: J. W. Mann, J. P. Nelson, and J. I. Moore.

Luling, Tex.—The City Council has contracted with a home company to put in a system of works. John Orchard is the Superintendent.

Boulder, Col.—At a recent meeting of the City Council a resolution was passed to the effect that no particular plan would be followed, but that the matter of getting water, and also the place of getting it, would be decided only after careful investigation made by the council and by a competent disinterested hydraulic engineer.

Colorado Springs, Col.—The bill granting Lake Moraine to the city, as a source for the new water supply, has been passed in the House of Representatives. It insures a supply of water sufficient for a city with 75,000 inhabitants.

PACIFIC.

North Yakima, Wash.—The Trustees of the North Yakima Water Co. are: Edward Whitson, James B. Reavis and Fred Parker. Capital stock, $150,000.

Seattle, Wash.—A supplementary report has been submitted by the Consulting Engineer, Benezette Williams, upon request of the City Council, providing for a water supply from Lake Washington. He closes his report as follows:

It is a demonstrable fact that the Cedar River plan will be cheaper within a comparatively few years, at an expense of $5,000,000, than would works on Lake Washington, of the best and most expensive quality, for nothing. This statement has not been, and cannot be, successfully controverted.

Los Angeles, Cal.—The City Water Co. is to lay a 44 in. pipe from Crystal Springs to the city, to replace the open flume now in use. The contract for furnishing the pipe has been awarded to the Lacy Mfg. Co., of Los Angeles.

Brigham City, Utah.—We have received the following:

There are no works here at present, but a majority of the citizens are in favor of having some party construct them. Address A. G. Snow.

Corinne, Utah.—Address Dr. F. E. Roche, Ogden, Utah, for information regarding the projected works.

CANADA.

Beauharnois, P. Q.—Engineer James Laurin has sent us the following:

The works will be constructed by the town by day labor. Estimated cost, $30,000, procured by bonds. Work will be commenced about May 1, and is to be completed before July 1. Water will be conveyed from the St. Lawrence River through an 8-in. flexible pipe, 1,800 ft. long, the end being protected by a crib 22x22x8 ft. This crib has been constructed, and the pipe has been laid. Hydrants will be used, and water will be furnished for domestic use. Designing Engineer, J. E. Vanier; Engineer in charge of surveys and construction, James Laurin, Room 60, 107 St. James St., Montreal, P. Q.

Chatham, Ont.—E. A. Bond informs us that the new works will be completed about Sept. 1. All the contracts have been let.

Toronto, Ont.—Petitions for a considerable amount of new mains have been granted. The contract for erecting the stand-pipe at the high level station has been awarded to the Canadian Bridge Co., of Montreal, at $3,140.

PROJECTS.

Gouverneur, N. Y.; Hinds & Bond, Watertown, N. Y. —Washington, Ga.—Uniontown, Ala.—Chatfield, Minn.; C. L. Thurber, Recorder. — Phillipsburgh, Kan. —Atkinson, Neb.; A. L. Morse.—Indianola, Neb.— Madison, Neb.—Grand Forks, No. Dak.—Mitchell, So. Dak.

ARTESIAN WELLS.

Franklin, Va.—A company has been formed to sink a well.

Macon, Ga.—Thomas Troy is at the head of a party to have a well bored. An expert has been engaged to undertake the work for $15,000, and if he does not produce a satisfactory flow of water he is to charge nothing for the effort. If this well proves successful, several others will be put down. A Troy party is willing to expend $10,000 or $12,000 if the city will contribute $2,500 or $5,000 to the expense.

Austin, Tex.—A well is to be sunk at the State Insane Asylum.

IRRIGATION.

Boise City, Idaho.—A mortgage has been filed on the property of the Idaho Mining and Irrigation Co., in favor of the Farmers' Loan and Trust Co., of New York, to secure payment of bonds amounting to $1,000,000. This sum is to be expended in this county in the completion of the largest irrigation canal in Idaho. It is also reported that the company has secured control of the Phyllis canal.

Garden City, Kan.—A. A. G. Stayton, of Hartland, Kan., has been awarded the contract of building the dams and doing the balance of the carpenter work on the Amazon ditch. It is estimated that $65,000 will be expended by this company this summer in completing the ditch to a point in Scott Co., $11,000 of which will be paid to Mr. Stayton on his part of the contract. The entire work is under the charge of U. D. Pickering of Garden City. [See also, note under Kansas City, Mo.—ED.]

Kansas City, Mo.—Consulting Engineer H. H. Filley has sent us the following:

The Amazon Irrigating Co. has been reorganized under the corporate name of The Southwest Kansas Land & Irrigation Co., Ltd. Contracts have been let for grading and timber work to the amount of about $28,000. Works to be completed by May 10. A good force of men and teams are already at work. [See also note under Garden City, Kan.—ED.]

New Mexico.—Press dispatches state that $2,000,000 have been paid in for the construction of a canal on each side of the Rio Grande River between El Paso and Pena Blanca, a distance of 300 miles, making in all 600 miles of canal. The new waterways are planned to be at a distance of about 12 miles on either side of the river bed, in some places 1,500 ft. above it, and will irrigate 500,000 acres of land, embracing fully two-thirds of the Rio Grande Valley in Mexico. The completion of the work will occupy about three years. Three thousand workmen are to be put to work next month, and the canals will be pushed to completion as rapidly as possible. Mr. Simpson is the Chief Engineer of the canal company. Ex-Congressman Tranquilino Luna, P. R. Simpson, and J. A. Weggin, of Albuquerque, are interested in the project.

SEWERAGE AND MUNICIPAL.

Sewerage.—The Sewer Committee of the Public Improvement Commission, Troy, N. Y., has reported in favor of the construction of several brick and pipe sewers in the southern district of the city. The report was adopted. A complete plan of a sewerage system for the city has been made.

The town of Orange, N. J., has decided to put in the system of sewers as approved by Mr. Ball, the engineer. The cost is estimated at $60,000 to $75,000. Mr. Wm. L. Grant is Chairman of the Sewer Committee.

The committee appointed by the President to investigate the sewerage of Washington, D. C., is not yet ready to report. The committee consists of Mr. Rudolph Hering, of New York; Mr. Samuel M. Gray, of Rhode Island; and Mr. F. P. Stearns, of Massachusetts.

The Big Stone Gap Improvement Co., of Big Stone Gap, Va., will receive bids for a sewerage system.

At Clifton Forge, Va., the construction of a sewerage system is contemplated.

A vote will be taken at Hastings, Neb., on the sewerage question, on April 3.

At Los Angeles, Cal., the vote on the issue of sewer bonds resulted in favor of the issue for the interior system, and against the storm drains and outfall sewer. The cost will be about $375,000.

Plans and specifications for a "separate" system of sewerage are invited by W. J. Dowler, Victoria, B. C. The corporation will pay $2,000 for the plans approved by it. Information may be obtained from the City Surveyor.

Street Work.—The pavement committee of the Public Improvement Commission, Troy, N. Y., has recommended for business streets granite-block pavements on concrete foundation: for business and residential streets combined, granite blocks with sand and gravel foundation; for residential streets, used for light traffic and pleasure driving, asphalt sheet pavements, where the grade does not exceed 4 per cent. The committee also recommends a limited experiment with compressed asphalt bricks, where light traffic only exists.

An election will be held at Buckhannon, W. Va., on the issue of $20,000 for street improvements.

At South Pittsburg, Tenn., bonds for $30,000 are to be issued for street work.

The City Engineer of Columbus, O., has prepared estimates for asphalt, stone block and Hayden or Hallwood block paving on several streets.

The Board of Public Works of Detroit, Mich., has begun the compilation of specifications for pavements. They will use no other kind of pavement than brick, asphalt and Medina stone. All petitions for wood pavement will be denied and brick substituted under the act authorizing the board to pave at a cost not to exceed $200,000.

At Litchfield, Ill., ordinances have been passed providing for about 6 miles of street paving.

At St. Paul, Minn., grading contracts have been awarded to Chas. Nonnemacher at $8,498, and to H. C. Huebner at $14,770.

Sewer Bonds.—N. W. Harris & Co., brokers, of Chicago, were the successful bidders for $250,000 of the $500,000 city hall and O. K. Creek sewer bonds, at Kansas City, at $247,868. The bids were as follows:

N. W. Harris & Co., Chicago	$257,868
Whitaker & Hodgman, St. Louis	256,430
R. L. Day & Co., Boston	255,792
Brewster, Cobb & Esterbrook, Boston	255,750
Farson, Leach & Co., Chicago	255,637
Adams, Blodgett & Co., Boston	253,125
Fidelity Trust Co., Kansas City	251,300
W. J. Hayes & Son, Cleveland	251,000

Garbage Disposal.—The Committee on Streets and Sewers, of the Board of Aldermen, Paterson, N. J., has appointed a sub-committee, with Inspector Leal, of the Board of Health, to report upon some system for the disposal of garbage by cremation. The Inspector says that the fertilizing material resulting from the burning of garbage could be sold for enough to pay the cost of the coal needed.

Street Cleaning.—At Brooklyn, N. Y., a contract for cleaning the streets for 3 years has been awarded to Furey & Co., of Brooklyn. The contractors have given a large order to W. C. Oastler, of New York, for "Barnard Castle" street sweeping machines.

Gas Works.—The City Council of Florence, Ala., has accepted a proposition for gas works to be established by a company at a cost of not more than $30,000. Work will be commenced shortly.

Water Power.—At Demorest, Ga., a masonry dam is being built across Camp Creek to furnish power for factories. It will be 270 ft. long and 17 ft. high. The power on Hazel Creek is being improved; it will be transmitted by electricity to a wagon factory, and will also be used for lighting the city by electricity. Mr. Baker N. Black, of Atlanta, Ga., is the engineer.

ELECTRICAL.

Electric Lighting.—The plant of the new electric light company, of Saratoga Springs, N. Y., will be located at the Geysers, where there is water power for running the dynamos. A Westinghouse plant will be put in.

At Greenfield, Mass., the following bids have been received for lighting the streets: The gas company offers to put up 95 lights on the different streets for $1,500, and light the town hall building and lock-up for $375 more. The electric lighting company will continue the present plan of lighting with 29 arc lights for $2,650, or for 15 arc lights, 3 incandescent and 45 kerosene lamps will charge $1,800. $350 for lighting the town hall building and lock-up.

At Boston, Mass., Mr. George H. Allen, Superintendent of Lamps, has reported the following estimates of cost of establishing and maintaining an electric light plant in the city. The estimates are based upon a plant sufficient to supply 1,000 arc lights of a nominal 2,000 c. p. in the streets where the present electric lights are in use, an increase from the present number, 800, on the same circuit. Inside construction, $131,000; outside construction, city proper, $85,000; Charlestown, $7,822.35; South Boston, $10,102.10; Roxbury, $10,109.10; Dorchester, $8,830.90; East Boston, $7,092.80; maintenance, $105,600; construction account, $259,957.25. These figures do not include buildings necessary for location of the station.

The city of Montgomery, Ala., has granted an electric lighting franchise to H. T. Beggs and others.

The Opelika Electric Light & Power Co., of Opelika, Ala., has awarded a contract to the Westinghouse Electric Co., of Pittsburg.

The Madison Gas Light & Coke Co., of Madison, Wis., has a contract for 7 arc lamps at $90 each.

The Fargo Gas & Electric Co., of Fargo, Dak., has a contract for lighting the city for one year at $12.50 per light per month. There will be 16 lights of 2,000 c. p.

At Denver, Col., a contract for 5 years has been made

with the Denver Consolidated Electric Co., at $12.50 per light per month.

The City Clerk, of San José, Cal., has been directed to advertise for plans, specifications and bids for lighting the streets with electric lights for a term of 5 years or less.

BRIDGES, TUNNELS AND CANALS.

Bridges.—*Bothwell, Ont.*—The contract for the bridge at this place has been awarded to a Mr. Gibson, of Beamsville, Ont., at $16.25 per cu. yd. for masonry, and $6 per cu. yd. for concrete. The cost of the bridge will be $14,900.

Montreal, P. Q.—The Montreal City Council has passed a resolution approving the passing of an act by the Dominion Parliament authorizing the construction of a bridge across the St. Lawrence River between that city and Longueuil, P. Q.

Ottawa, Ont.—Bills to incorporate the St. Lawrence & International Ry. & Bridge Co. and the Thousand Islands Bridge & Ry. Co. to bridge the St. Lawrence, and to empower the Napanee, Tamworth & Quebec Ry. to do the same, have been thrown out by the Railway Committee in the Canadian Parliament.

Holyoke, Mass.—Bids will be received until April 15 for the substructure and superstructure of an iron plate-girder bridge over the upper level canal on Dwight St., at his place. Address E. L. Squier, Holyoke.

Cohoes, N. Y.—A bill has passed the New York State Legislature appropriating $25,000 for a bridge over the Champlain Canal at this place.

New York, N. Y.—The House Committee on Commerce has approved the bill for the bridge across the North River.

Newark, N. J.—A petition is being circulated for a bridge at the foot of Madison St., Newark, N. J.

Trenton, N. J.—The following bids have been received for the construction of two 50-ft. fixed spans and one 136-ft. draw span at this place:

King Bridge Co.	$18,100
Penn "	17,175
Dean & Westbrook "	17,950
Pittsburg Bridge Co.	16,620
Berlin "	19,390
Canton "	20,500
New Jersey Steel & Iron Co.	16,892

Columbus, O.—Bills have passed the Ohio State Legislature providing for the erection of bridges over Mill Creek and the Cincinnati, Hamilton & Dayton R. R., in Hamilton Co.

Big Stone Gap, Va.—The Big Stone Gap Improvement Co. will receive proposals for constructing an iron bridge.

Damascus, Va.—It is reported that bridges will be built across South Fork River and Beaver creek at this place.

Lexington, Va.—The Board of Supervisors of Rock. bridge Co. will soon let contract for the construction of iron bridges at Goshen Bridge and Riverside

Mount Meridian, Va.—C. Eakle, of New Hope, will shortly let contract for the construction of an iron bridge across Middle River.

Wheeling, W. Va.—An ordinance has passed the City Council providing for the issue of $100,000 of bonds, the proceeds to be used in the construction of a bridge on Maine St., over Wheeling Creek.

Jacksonville, Fla.—Work on the viaduct over the Bridge St. crossing has been commenced, and the first excavations made for the foundation. W. A. Macduff has the contract for the substructure, the piles and foundations. He will soon commence that part of the work. The foundation will be of brick and stone, supported by piling underneath. The contract of the superstructure has been awarded to the Groton Bridge Co., which will erect the entire upper work of iron and steel. The viaduct, including the approaches, will be 1,100 ft. long and 60 ft. in width. The main bridge will be 834 ft. in length. There will be two roadways, two sidewalks and two street car tracks. The incline at the approaches will be only 6 ft. in a hundred, much less than many structures of this kind. The work must be finished and open for travel by Sept. 13, according to contract. There will be one large span over the S. F. & W. tracks and three smaller ones, the remainder being iron and steel trestle-work.

Greenwood, Miss.—It is proposed to construct a bridge over the Yazoo River.

St. Paul, Minn.—Bids for the construction of the substructure of the Sixth Street bridge between Brook St. and Hoffman Ave., this city, are asked for. Address Thos. A. Prendergast, City Clerk.

St. Paul, Minn.—Bids have been received for the construction of the substructure for the bridge across the right of way of the Chicago, Milwaukee & St. Paul Ry. Co. along the line of Selby Ave., together with the necessary grading of Selby Ave. between Hamline Ave. and Saratoga Ave., as follows:

Thornton & Shaw	$21,699 00
H. M. Nevin	23,250 00
Charles Stone	21,575 00
Morris & Foley	22,127 30
Edward J. Kirkland and Albert R. Starkey	23,803 00
John D. Moran	23,500 00

Charles Stone being the lowest reliable and responsible bidder, the contract was awarded to him.

Crookston, No. Dak.—Arrangements have been made by the Northern Pacific and the Duluth, Crookston & Northern railways for the construction of a bridge across the Red Lake River, at this place.

Deuel Co., Neb.—The citizens of Deuel county will vote April 1 on a proposition to issue $10,000 in bonds to build a bridge across the North Platte River, 25 miles east of Chappell. The improvement is badly needed, as the river is not fordable more than six months in a year, and people are obliged to travel from 40 to 60 miles to get to town.

Nebraska City, Neb.—Nebraska City Highway Bridge Co. has been organized and has submitted to the people of Nebraska City precinct a proposition to build a high wagon bridge over the Missouri River. It proposes to build a bridge to cost $300,000 or $500,000, and a bonus of $100,000 in 20-year 5 per cent. bonds to be delivered on the completion of the bridge; work to commence by July 1, 1890, and be completed by September 1, 1890.

Sioux City, Ia.—The Pacific Short Line Bridge Co has been incorporated for the purpose of building a railroad bridge across the Missouri River at Sioux City, Ia., for the Pacific Short Line road, which is building from Sioux City, to Ogden, Utah. The capital stock is $10,000,000, and the Directors are Donald McLean, John Pierce, Craig L. Wright, Leverett H. Clarke, and David Mackenzie. The officers are: David Mackenzie, President; L. H. Clarke, Vice-President; C. L. Wright, Secretary; D. McLean, Treasurer and General Manager.

St. Paul & Northern Pacific R. R. Co.—Shailer & Schniglau have been awarded the contract for constructing three double-track steel girder spans for St. Paul & Northern Pacific R. R.

Helena, Mont.—Bids for the construction of a bridge across the South Fork of the Sun River, at the site of the old bridge near Augusta, Lewis and Clark County, Mont., are called for. J. S. Tooker, Clerk, Helena.

Redding, Cal.—The following bids were received for the Repair of the Redding Bridge: The American Bridge Co., $5,077, $5,771 and $6,643; the San Francisco Bridge Co., $7,540 and $5,887; the King Bridge Co., $7,531; E. Marwick, $7,107; the Pacific Bridge Co., $6,136; $5,486; $6,790 and $6,140; the California Bridge Co., $5,360, $6,860, $5,960, $7,160 and $8,909).

Oregon & Washington Bridge Co.—The Senate has passed a bill authorizing this company to build a bridge over the Columbia River, between Oregon and Washington.

Canals.—A bill has been introduced in the Washington Legislature authorizing the Washington Improvement Co. to construct a ship canal from the head of Salmon Bay to deep water in Admiralty Inlet.

CONTRACTING.

Street Work.—The Board of Contract and Apportionment, Albany, N. Y., has awarded the contract for granite block pavement on Hamilton St. to A. N. Brady, at $62,503.80: Granite, $3.05 per sq. yd; curbing, $1.50 per lin. ft.; circular curbing, $2 per lin. ft.; relaying old curb, 65 cts. per ft.; circular walk, 45 cts. per sq. ft.; relaying granite, 75 cts. per sq. yd.; relaying cobbles, 50 cts. per sq. yd. The contract for granite paving on Jay St. has been awarded to Jacob Holler, at $44,137.45: $2.98 per sq. yd. for granite, $1.55 and $1.95 per lin. ft. for straight and circular curbing, 64 cts. per ft. for relaying old curb, 43 cts. per sq. ft. for sidewalks; 85 and 50 cts. per sq. yd. for relaying granite and cobble paving.

The contract for repaving the transverse road through Central Park at 85th St. has been awarded by the Park Commissioners, New York City, to Geo. F. Dope, at $10,126.76.

The contracts for graveling streets at Dayton, Ky., have been awarded to Charles Spinks and John Trapp, at $1.65 to $2.37 per front ft.

At Kansas City, Mo., the following contracts for city work have been awarded by the City Engineer: Dennis Finucane, grading alley between 11th and 12th Sts., from Park to Olive at 25 cts. per cu yd.; to W. Hickman grading Ash St. between Independence and 9th, at 13¾ cts. per cu. yd.; to John O'Flaherty, grading Indiana Ave. between 12th and 15th, at 12¼ cts per cu. yd.; to L. Stillwell, grading Phelps Ave. between Highland and Maple, at 14¾ cts. per cu. yd.

Asphalt Paving.—The following proposals for paving Clinton St., 19th St., Woodlawn Ave. and Glenwood Ave., respectively, have been received by the City Engineer, Buffalo, N. Y.: Buffalo Vulcanite Asphalt Paving Co., $165,949.99, $5,206, $55,141.92 and $25,380.66. Barber Asphalt Paving Co., $164,068, $5,256, $55,997 and $25,561.

At Lockport, N. Y., the contract for paving Walnut St. has been awarded to the Barber Asphalt Paving Co at $3 per sq. yd.

Sewers.—At Wilmington, Del., the following bids for the construction of an intercepting sewer were opened March 18: John Jacoby, Bridgeport, Conn., $49,416.40; R. A. Malone & Co., Lancaster, Pa., $54,519.95; Everson & Liddle, Yonkers, N. Y., $63,088.85; Henry C. Eyre, Chester, Pa., $71,934.75; Kennedy, Dehan & Co., Philadelphia, Pa., $91,051.25; Thos. J. McGovern, Trenton, N. J., $92,170.30; John McParland, Philadelphia, Pa., $99,228.95; A. S. Ried & Bro., Wilmington, Del., $111,625; Thomas Craig, Trenton, N. J., $119,012.05. The contract was awarded to John Jacoby, of Bridgeport, Conn. The building of this sewer is a difficult work, as the ground is very rocky and wet; in several places it crosses under a canal from which the city obtains its drinking water and which water cannot be stopped off or interferred with during the progress of the work. Geo. H. Boughman is Chief Engineer, and T. Chalkley Hatton, First Assistant Engineer, in charge of Sewers.

The contract for sewers at Norwood Park, Ill., has been awarded by H. A. Donaldson, Village Clerk, to the Racine Construction Co., of Racine, Wis.: 12, 15 and 24-in. pipe 53 cents, 77 cents and $1.39 per lin. ft.; manholes, $27.50 each; catch basins, $32.55 each.

The Water and Sewer Commissioners, Poughkeepsie, N. Y., have awarded the contract for the completion of the Main St. sewer to Charles Cook at $9,505. The other bids were as follows: M. Sullivan, Little Fall.; $11,088.40; E. Hochstadter, $12,204.10; Con. Daley, 13,200; P. H. Ward, $14,428.

Pier Work.—The contract for repairing the pier at 55th St., North river, has been awarded by the Docks Commissioners, New York City, to John D. Walsh at $5,544. John W. Flaherty bid $5,886, and Walls & Van Riper $6,173.

G. J. Anderson, of West Superior, Wis., has the contract for dredging and piers on Howard's Bay for the American Steel Barge Co.

Public Buildings.—The following proposals for the construction of a public building at Winona, Minn., have been received by Jas. Windrim, Supervising Architect, Treasury Department, Washington, D. C.: Grant & Moonan, Winona, $97,400 and $93,950; John Carlisle & Sons, Minneapolis, $131,240; Geo. Van Horn, Washington, D. C., $100,968; Kratz & Butler, Winona, $107,356; V. B. Craig, Mankato, $106,974; L. L. Leach & Son, Chicago, $110,983; H. H. Edgerton & Co., Rochester, N. Y., $107,717; Henry Shenck, Erie, Pa., $128,952, with other specifications, $119,152 and $113,872; Chas. W. Gendel, Chicago, $93,783; Walter Butler, St. Paul, $103,900; E. F. Gobel, Chicago, $113,967.96; Haglin & Morse, Minneapolis, $102,843; Conrad Dotin, Winona, $118,400; F. A. Fisher & Co., Minneapolis, $106,000; Young & Farrell, Diamond Stone Co., Chicago, $148,500; Cudel & Blumenthal, Chicago, $144,150; Minick & Lohse, Winona, $97,019.

At Kosciusko, Miss., a new jail is to be built by the county commissioners.

Plans, specifications and bids for a jail 17x18 ft., with two rooms, will be received until April 7, by J. Green, Mayor, Halletsville, Tex.

The Keeseville Granite Works, of Keeseville, N. Y., has a $100,00) contract for stone for the new criminal court building, New York City.

Piles.—The following bids have been received by the Docks Commissioners, New York City, for 2,100 piles: Alfred J. Murray, class 1, $20 each; class 2, $12.50; class 3, $10.75; class 4, $8.50; class 5, $7.25; total, $20,737.50. C. N. Kimpland, $21, $13, $11, $8.70, $7.10; $21,245. Rowland A. Robbins, $18.21, $11.74, 12.20, $9, $9; $21,947. Joseph Walsh, $19, $13.50, $11, $10, $8; $22,735. The contract was awarded to A. J. Murray. Class 1, 170 piles, 75 to 85 ft. long, 17 ins. diameter at butt and 7 ins. at point; class 2, 130 piles, 70 to 75 ft. long, 14 to 6 ins. diameter; class 3, 350 piles, 65 to 70 ft. long, 14 to 6 ins. diameter; class 4, 1,150 piles, 60 to 65 ft. long, 14 to 6 ins. diameter; class 5, 300 piles, 55 to 60 ft. long, 14 to 6 ins. diameter.

Brick.—The contract for bricks for lighthouse work in Maine has been awarded to Benj. Dodge, Jr., of Newcastle, Me., at $23 per M. for Eastern Point, $13 per M. for Great Duck Island, and $12.75 per M. for Goose Rocks. Nathaniel Bryant, of Damariscotta, Me., bid $13.25, $12.70, and $13 respectively.

Hoisting Engine.—The Docks Commissioners, New York City, have awarded the contract for a Lidgerwood double cylinder, double friction drum hoisting machine, to H. A. Rogers, at $1,415. The Lidgerwood Mfg. Co. bid $1,450.

Dredging.—The contract for dredging at the fish wharf, Alexandria, Va., has been awarded to the River & Harbor Improvement Co., of Georgetown, D. C., at 15 cts. per cu. yd. The Alexandria Marine Ry. Co. bid 18 cts.

Embankment.—The following proposals for extending the Great Miami embankment at Lawrenceburgh, Ind., were opened at the U. S. Engineer Office, Cincinnati, O., March 19, by Lieut.-Col. Wm. E. Merrill, Corps of Engineers. The contract was awarded to John W. Scott & Co:

Bidders: John W. Scott & Co., Aurora, Ind., 21 cts. per cu. yd., aggregate, $2,310; John Johnson, Crawfordsville, Ind., 21 cts. per cu. yd., aggregate, $2,310; Paul & Tietje, Dayton, O., 23 cts. per cu. yd., aggregate, $2,530; Bailey H. Lowe, Lawrenceburgh, Ind., 24½ cts. per cu. yd., aggregate, $2,695; Richard Block, Aurora, Ind., 24½ cts. per cu. yd., aggregate, $2,695; Murdock & Co., Aurora, Ind., 25½ cts. per cu. yd., aggregate, $2,805; John C. Graham, Gallipolis, O., 26 cts. per cu. yd., aggregate, $2,890.

Hoisting Plant.—The Aqueduct Commissioners, New York City, have awarded the contract for two portable engines to the West Point Machine Co. at $3,900 each.

PROPOSALS OPEN.

Well.—Furnishing plant and drilling oil well. W. C. Burry, 39 Ohio St., Allegheny, Pa.

Water-Works.—Franchise and construction of works. J. L. G. McCarthy, Chairman of Water-Works Committee, Barrie, Ont., Canada.

Lumber.—For the protection piers and foundations of the pivot span of Light St. bridge. A. E. Smyrk, City Commissioner, Baltimore, Md. April 1.

Sewers.—About 1 mile. W. H. Richards, City Engineer, New London, Conn. April 3.

Electric Lighting.—The Lighting Committee, Wilkinsburg, Pa. April 4.

Piles and Rip-rap.—Furnishing 400 piles, 80 to 85 ft. long, 16 ins. diameter at butt and 6 ins. at point. Furnishing and putting in place 9,000 cu. yds. of small cobble stone; 11,000 cu. yds. of rip-rap stone. The Docks Commissioners, Pier A, North River, New York City. April 4.

Sewers.—Sewerage system, cost estimated at $60,000 to $70,000. Engineers, Nier, Hartford and Mitchell, of Chattanooga, Tenn. The Sanitary Committee, Florence, Ala. April 5.

Brick Paving.—Vitrified brick. Forrest Adair, Chairman of West End Street Committee, Atlanta, Ga. April 7.

Street Work.—Excavating, curbing, flagging and laying Trinidad sheet asphalt on concrete foundation. Also sewers. T. J. Lanahan, Clerk of Board of Contract, Albany, N. Y., April 7.

Water-Works Supplies.—Cast-iron pipe, kalamein pipe, lap-welded wrought-iron screw pipe, 70 hydrants, 90 gates, specials, etc. Also 15,400 ft. of trenching. B. B. Harris, Clerk of Board of Trustees, San Bernardino, Cal. April 8.

Stone and Sand.—Rubble stone and sand for use on the public roads; stones not less than 4x4x7 ins. John T. Cooper, Clerk of Road Commissioners, Atlanta, Ga., April 8.

Iron Work.—Metal work of South Pass East Jetty lighthouse and fog signal. Capt. W. L. Fisk, U. S. Lighthouse Engineer, New Orleans, La. April 10.

Railway.—About 8,700 ft. of clearing and grading roadbed, comprising 55,000 cu. yds. of earth excavation. Geo. H. Clark, Chief Engineer, Cedartown, Ga. Chas. P. Ball, Receiver and Manager, East & West R. R. of Alabama, Cartersville, Ga. April 14.

Building.—Brick building with slate roof, 34½ ft. square. J. M. Marsh, Superintendent of Bridges and Buildings, Sioux City & Pacific R. R., Omaha, Neb. April 15.

Bridge.—Substructure and superstructure for iron plate girder bridge over the upper level canal on Dwight St. Specifications prepared by the City Engineer. E. L. Squier, Chairman of Committee on Highways and Bridges, Holyoke, Mass. April 15.

MANUFACTURING AND TECHNICAL.

Locomotives.—The Rhode Island Locomotive Works, of Providence, R. I., have built a consolidation engine for the Denver, Texas & Fort Worth. Cylinders, 20x24 ins.; driving wheels, 50 ins. diameter; weight, 122,000 lbs., with 109,500 lbs. on the driving-wheels.

The Manchester Locomotive Works, of Manchester, N. H., have an order for 20 engines for the Boston & Maine; this number includes passenger, freight and switch engines.

The Roanoke Machine Works, of Roanoke, Va., have turned out an engine for the Norfolk & Western. It is for use on the heavy grades in southwest Virginia.

The Baldwin Locomotive Works, of Philadelphia, Pa., have delivered one of four engines for the Chicago & Indiana Coal road. A 40-ton engine has been built for the Satosp road, in Washington.

A new engine has been built by the New York, Lake Erie & Western at the Susquehanna shops for hauling heavy passenger trains. It weighs 97,000 lbs. on the drivers and 15,000 lbs. on the trucks, making a total of 112,000 lbs. It is said the company intends to build 7 more of the same pattern, if this one proves satisfactory. The new engine will eventually go into service on the western division.

The Cleveland, Cincinnati, Chicago & St. Louis will sell a number of the light engines which have come into possession of the company through recently acquired lines, and replace them with heavier machines.

Locomotive Fire Engines.—The New York, Lake Erie & Western is equipping its switch engines with pumps for fire service, and it is said that one-half of the switching locomotives will be made moving fire engines. The pumps will take water from the locomotive tanks and will be able to throw a stream 80 ft. A number are already in use.

Cars.—The Wagner Palace Car Co. has turned out a new boudoir and buffet sleeping car for service between Detroit and Cincinnati, over the Michigan Central and the Cincinnati, Hamilton & Dayton roads. The car is about 78 ft over all. It contains 12 regular sections, having in all 29 double berths and one single berth. It is said that the lamps are so arranged as to be automatically extinguished in case of an accident.

The New York Central R. R. has built 24 cabooses, 12 baggage cars and several box cars at its Buffalo shops.

The Tyler Car Mfg. Co., of Tyler, Tex., is building cars for the International & Great Northern.

The Lafayette Car Works, of Lafayette, Ind., will build the 1,000 cars for the New York, Pennsylvania & Ohio at the shops in Lima. In the shops at Lafayette they are building cars for the Cincinnati, Hamilton & Dayton and the Pennsylvania.

The Jackson & Sharp Co., of Wilmington, Del., has completed some passenger cars for the Louisville, St. Louis & Texas.

The Pennsylvania Co. is building at its shops in Columbus, O., a combination car in which linemen are to travel. It is fitted with berths, kitchen and dining room.

The Park City St. Ry. Co., of Parkersburg, W. Va., will probably purchase four double platform street cars; second hand if in good order. Address, S. F. Shaw, Superintendent.

Cabooses.—Master Mechanic McKenna, of the Indianapolis, Decatur & Western, has turned out of the shops at Indianapolis two model cabooses of his own design. They are fitted with sleeping accommodations for four men, wash-room, and all conveniences found in an ordinary boarding house, which will be very convenient when the trainmen are obliged to lay over at a terminal. These cabooses are 34 ft. long, rest on two 4-wheeled trucks, and are so arranged that a brakeman can go on to the top of his train without climbing up the sides or over the ends.

The Gilbert Car Mfg. Co., of Troy, N. Y., is crowded with orders. The works cover about 12 acres; the buildings are heated by steam and are fitted with automatic sprinklers for extinguishing fires. Passenger cars, with mahogany sides, and baggage cars are being built for Brazil. About 1,000 freight cars are being built for the Cordova Central Ry., in the Argentine Republic. As fast as the cars are completed in sections they are prepared for shipment by vessels from New York. The ends of the cars and the sides are packed separately, and every distinct piece of wood and iron is so arranged that no mistake can be made in putting the cars together when they reach their destination. The cars will be set up in Buenos Ayres. There are also in course of construction several hundred cars for the Bahia-Blanco and Santa Fe Northern railways, in the Argentine Republic. The company has shipped a dozen electric cars for street railways in Italy, and a sample car of the same construction is being built for transportation to Germany. Besides the building of cars for the steam and street railways the company is building many trucks for electric railways, the truck being patented by B. F. Manier, the general superintendent of the works. Another order for 150 freight cars for Chili is being shipped. The cars will go either around Cape Horn by vessel or be transferred at the Isthmus of Panama to the Pacific, and thence down the western coast of South America to Valparaiso. In addition to the passenger cars a large number of sleeping cars, directors' cars and private cars are being built for the railways mentioned. A fine lot of vestibule street cars have been built for the Utica belt line, and are to be operated by electricity; also 35 street cars for the Albany Ry. to be run by electricity. Still another order for a foreign country is being filled—passenger cars for a railway in New Zealand. All these orders are in addition to the usual demand for cars for various parts of the United States.

Snow Plow.—Edwin Payne, of Ox Bow, N. Y., has invented a double elevating ironclad railway snow plow, which has been on the Grand Trunk Ry. on trial for about 20 days, between Richmond and Quebec. The plow is constructed with conductors on either side having upright and horizontal knives to cut the snow in shape to pass up the conductors, which have an elevation of 1 in 4, discharging the snow at the rear end of the plow 8 ft. above the track. The first 4 ft. of snow above the rails is pressed 19 ins. each way at the front of the plow, then cut and passed up in a straight line about two-thirds the length of the conductors and discharged at the rear end of the plow with a gradual throw out, throwing the snow over the fences into the fields when running in deep snow. All the snow above the first 4 ft. is elevated again at the front end of the plow and thrown out. Working at both ends of the plow at the same time the plow divides the snow into four parts, each part being disposed of by itself.

Signals.—The Berry Signal Lock & Target Co., of Chester, S. C., has been incorporated by J. D. Berry, L. B. Nichols, and J. K. Henry. Capital stock, $15,000.——A company has been organized by capitalists of Norwalk and Toledo, O., to manufacture the Fontaine signal, which indicates by a dial and hand the time (up to 20m.) since a train has passed. The works will be located at Detroit, Mich. The incorporators are Eugene Fontaine, Joseph Taylor, D. R. Shaw and others.——The block system of signals is ready for use on the New York, Lake Erie & Western between Port Jervis and Lackawaxen, on the Delaware Division. The signals are 2½ miles apart.

The New Jersey Asphaltic Concrete Co. has been incorporated by J. Kean, Jr., John R. Moore, E. M. Wood, Prof. J. Madison Watson and Frank Bergen, of Plainfield; T. W. Berger, L. Bradley, Chas. M. Fowler, C. L. Little, P. D. Van Saun, J. K. McCandless and R. F. Ham, of Cranford; William T. West, A. F. Aitken, D. E. Smith, George W. Peck, N. W. Ferris, of Roselle; George Kyte, of Fanwood; Walther Luttgen and Oscar Gessner, of Linden. The capital stock is $100,000. The purpose is to establish works for the manufacture of drain pipe, flagging and building foundation stones, from a patented asphaltic concrete. The patent is in the process.

Pneumatic Conveyor.—The Beach Pneumatic Conveyor Co. has been incorporated at Chicago with a capital stock of $500,000, for the manufacture of machinery and pneumatic pipe lines for the collection and transfer by pneumatic process of the mails, grain and other commodities. Incorporators, L. T. Michener, J. W. Beach, F. C. Shayes and others.

The Osage City Pressed Brick Co., of Osage City, Kan., has been incorporated by C. B. Parker, Charles Stockborn and D. C. Lake. Capital stock, $10,000.

The Laidlaw & Dunn Co., of Cincinnati, O., has added a new building to its premises. This adds 13,000 sq. ft. of floor space, giving in all 45,000 sq. ft. of floor space for manufacturing, warehouse and office purposes, besides the pipe yards. The works are fully equipped with first class tools for turning out "Duplex" steam pumps and other machinery. The new premises will contain the offices and the merchandise branch of the business, where a full line of pipe-fittings, brass work and general supplies for steam fitters, mill work, etc., is carried. The pipe department is fitted with machinery to cut and thread all sizes up to and including 15-in. pipe.

English, Morse & Co., of Kansas City, Mo., report large sales of their specialties, including Jewell electric belting, American leather link belting, Hill clutch pulleys, and Lahman-Kirkwood rocking grates, in addition to their regular line of steam engines and boilers, and complete steam plants. They will furnish a complete rock crusher outfit to the Fort Scott R. R., consisting of a No. 4 Gates Crusher and a 30 H. P. Atlas engine and locomotive boiler. They also have a contract from the Urie Dredge Mfg. Co, for the steam equipment of the new bridge to be used at Galveston. The outfit consists of a 45 H. P. Atlas engine and boiler and a 6-in. centrifugal pump. They report a number of sales of engines, boilers etc., including hoisting engines for Colorado, and a 300 H. P. Heine safety boiler.

The Buffalo Steam Forge Co. has been organized at Buffalo, N. Y., and will carry on the business of manufacturing general forge work, car axles, railway forgings, general-shape work and smithing. Capital stock, $25,000. The trustees for the first year are Henry B. Stinson, Benjamin F. Taylor and Spencer Clinton.

Filters.—The Chicago Pure Water Co., of Chicago, has been incorporated at Chicago by A. C. Thatcher, R. R. Towne and G. N. Harris, to purify water for domestic and other purposes. Capital stock, $500,000.

The Railway Device Mfg. Co., of Chicago, has been organized by George McElwain, E. N. Gifford, and Julian Kune. Capital stock, $100,000.

Steam Engines.—The Periphery Steam Engine Co., has been organized at Chicago by Bruno Beck, Edward G. Fish and Frank C. Rutan, to build steam engines under the Beck patents. Capital stock, $350,000.

Welding.—The Burns Copper Welding & Mfg. Co., of Chicago, has been organized by W. J. McKeever, James Murphy and Charles Maginn, for the welding of metals. Capital stock, $500,000.

The Dunham Mfg. Co., Chicago, Ill., together with the National Hollow Brake Beam Co., owing to their rapidly increasing business, will remove to new quarters, 703 to 707 Phenix Building, on April 1. The new location will give them about double the space now occupied at 310 and 311 Phenix Building.

Ice Machine.—The Jackson Ice Mfg. & Machine Co., of Jackson, Miss., wants estimates at once for a 10 or 15-ton ice machine, complete. President, G. Y. Freeman; Secretary, Luther Manship.

Railway Material.—The Big Stone Gap Improvement Co., of Big Stone Gap, Va., will purchase material and equipment for a belt road six miles long.

The Abbeville Investment & Construction Co., of Abbeville, Ga., will purchase locomotives and cars for the Abbeville & Waycross R. R.

Metal Market Prices.—***Rails.***—New York, $34 to $34.50; old rails, $24.50 to $25 for iron, $21.50 for steel. Chicago: $35 to $36; old rails, $23.50 for iron, $21 to $21.50 for steel. Pittsburg: $33 to $34; old rails, $25.50 to $26 for iron, $22 to $23 for steel.

Track Materials.—New York: steel and iron angle bars, 2.10 to 2.15 cts.; spikes, 2.10 to 2.20 cts.; track bolts 2.9 to 3 cts. with square and 3.10 to 3.15 cts. with hexagon nuts. Pittsburg: splice bars, 1.95 to 2 cts.; spikes, 2.15, or 2.25 cts. delivered at Chicago or St. Louis; track bolts, 2.90 to 3 cts. with square and 3.10 to 3.20 cts. with hexagon nuts. Chicago: splice bars, 2.10 cts. for steel and 1.90 to 2 cts. for iron; spikes, 2.25 cts.; track bolts, 2.90 to 2.95 cts. with square, and 2.95 to 3 cts. with hexagon nuts.

Pipe.—Cast iron, about $27 to $30 per ton, according to competition and amount of order. Wrought iron, discounts as follows: 47½ and 40 per cent. on black and galvanized butt-welded, 60 and 47½ on black and galvanized lap-welded. Casing, 50 per cent. discount.

Lead.—New York, 3.82½ to 3.97½ cts.; Chicago, 3.80 cts.; St. Louis, 3.80 cts.

Structural Material.—Chicago: iron or steel angles, 2.45 to 2.55 cts.; tees, 3 cts.; universal plates, 2.50 cts. for iron; 2.55 cts. for steel up to 16 ins. wide, 2.70 for wider steel; steelsheared plates, 2.80 cts.; beams and channels, 3.20 to 3.40 cts. Pittsburg: angles, 2.30 cts.; tees, 2.75 cts.; channels, 3.10 cts.; sheared bridge plates, 2.80 cts.; universal mill plates, 2.45 cts.; steel plates, 4.25 to 4.75 cts. for firebox; 3.25 cts. for flange, 3 for shell, 2.75 for tank.

Nails.—Pittsburg: steel cut nails, $2.25, 60 days, 2 per cent. off for cash; wire nails, $2.75, 60 days, 2 per cent off for cash.